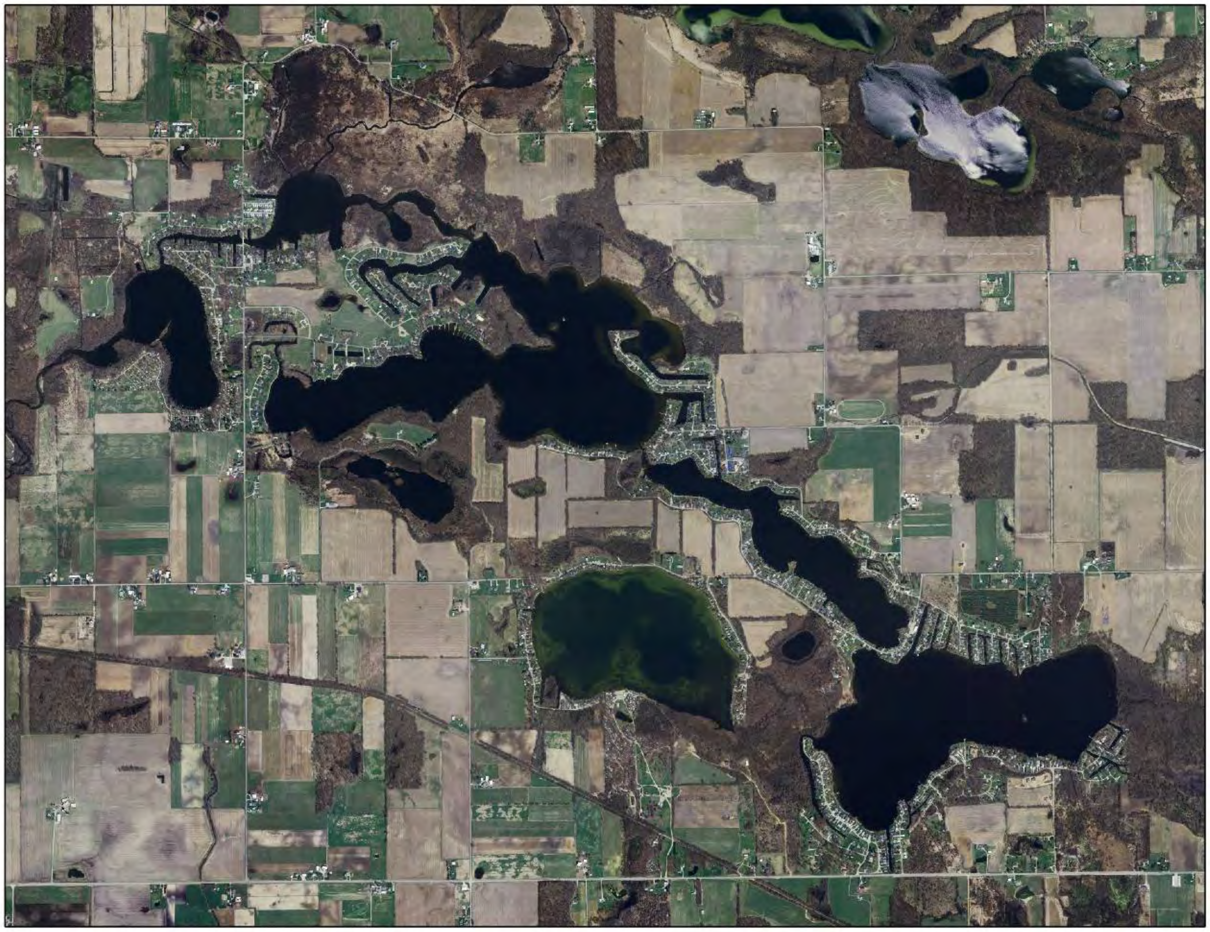
Five Lakes Aquatic Plant Management Plan Update 2007
Lagrange County, Indiana

22 February 2008



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FIVE LAKES AQUATIC PLANT MANAGEMENT PLAN UPDATE 2007
LAGRANGE COUNTY, INDIANA

EXECUTIVE SUMMARY

This document is intended to update the 2004 Aquatic Plant Management Plan and the 2006 Update for the Five Lakes (Witmer, Westler, Dallas, Hackenburg, and Messick lakes) in Lagrange County, Indiana. The following update specifically addresses the results of the aquatic plant surveys conducted during the 2007 season and compares the results with variations in the plant communities in the lakes over a period of the past four growing seasons. The Aquatic Plant Management Plan of 2004 should be consulted for complete information regarding aquatic plant management at Five Lakes. Likewise, the 2006 Aquatic Plant Management Plan Update for 2006 should be reviewed for additional details from the last growing season.

Two aquatic plant surveys and aquatic herbicide application occurred in 2007 with funding from the Lake and River Enhancement (LARE) program. The first survey occurred in June and was completed to identify locations of exotic species, while the second occurred in August and was used to determine the nature of the plant community and effectiveness of treatment. Aquatic herbicide application included treatment of approximately 10 acres of Eurasian watermilfoil within Dallas, Hackenburg, and Messick lakes at a cost of $3,750. Survey results indicate that aquatic plant growth tends to decline in the Five Lakes as water quality and clarity declines. Aquatic plants within the Five Lakes are limited by the substrate available for colonization and by the amount of light available for them to photosynthesize. Plant densities declined from those observed during the June surveys to the relatively sparse communities that were present during the August surveys. Eurasian watermilfoil was noted as growing in high abundance in approximately 47 acres of the Five Lakes during the June surveys. However, most of this growth declined to manageable levels at the time of the August surveys. The decline in Eurasian watermilfoil density and distribution is likely due to two factors: natural aquatic plant community density declines due to reduced water clarity throughout the season and chemical control of Eurasian watermilfoil. In the areas where chemical control occurred, specifically high density or high use areas within Dallas, Hackenburg, and Messick lakes, declines in Eurasian watermilfoil density are likely due to chemical application. However, declines throughout the lake chain are more likely due to reduced water clarity. The Five Lakes Chain is renowned for their poor water clarity mid-summer. Annually, this decline reduces the overall plant density and dominance reducing the plant community to sparse densities in shallow areas throughout the lake chain. Due to the limited area of treatment and the prevalence of density declines, data suggest that water clarity affects the overall density of Eurasian watermilfoil within the Five Lakes more than chemical control. It is difficult to determine the level of control attributed to each methodology. However, it should be noted that Eurasian watermilfoil abundance in 2007 was lower than abundances observed by Weed Patrol in 2004, by the DNR in 2005, and by JFNew in 2006.

Comparing the 2004, 2005, and 2006 Tier II survey metrics indicates that the quality of the native aquatic plant community in all of the lakes is increasing. Similar densities and diversities of submergent plant species were observed within the Five Lakes during the current assessment as compared to 2006 survey data. These data indicate increased density and diversity of natives than in previous years. Relative and mean densities for most species are relatively low with the exception of coontail in Hackenburg and Messick lakes. All five lakes possessed metric values that were greater

than the average values for plant community metrics found by Pearson (2004) for 21 northern Indiana lakes.

Additional items including a public meeting and a meeting between the contractor, LARE program staff, the district fisheries biologist, and a representative from the Five Lakes Conservation Association, Inc. (FLCA), also occurred in concert with this aquatic plant management plan update. The details of these are not repeated here, but were utilized to generate recommendations as follows:

1. Treatment of approximately 19 acres of Eurasian watermilfoil in high usage or heavy traffic areas.
2. Reassessment of the lakes following water quality project implementation within the watershed. Improving the water quality entering the lakes will likely result in increased clarity and light penetration which will ultimately result in more aquatic plant growth.

Estimated costs for 2008 assessment and treatment are as follows:

- Eurasian watermilfoil treatment: maximum total cost of $7,125.
- Assessment and plan updates costs are based on 2007 requirements and are estimated to total $13,000.
- Total fees for 2008 aquatic plant assessment, herbicide application, and plan updated are estimated at $20,125.

ACKNOWLEDGEMENTS

The Indiana Department of Natural Resources Division of Fish & Wildlife as part of the Lake and River Enhancement Program (LARE) provided funding for the development of this plan. The plan has been developed in cooperation with the Five Lakes Conservation Association. Thanks to Bob Christen and John Buck for their time, enthusiasm, and driving abilities. Fieldwork, data analysis and map generation was performed by JFNew with the assistance of Five Lakes Conservation Association volunteers. The authors of this update include Sara Peel and Betsy Ewoldt.

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1.0 Introduction

This report serves as an update to the 2005 Indiana Chain of Lakes Aquatic Plant Management Plan 2005-2008 completed by Weed Patrol, Inc. The update will serve as a tool to track changes in the vegetation community, to adjust the action plan as needed, and to maintain eligibility for additional Lake and River Enhancement (LARE) funds. Items covered include a review of details of the 2007 vegetation control efforts (LARE and non-LARE funded); spring aquatic plant community mapping; summer Tier II survey methods and results from the 2007 season; a comparison of Tier II results from 2004, 2005 (IDNR), 2006, and 2007 from all available data sources; a recap from the public meeting; and a discussion of potential management implications of the results. The plan update was funded by the Indiana Department of Natural Resources (IDNR) Lake and River Enhancement Program (LARE) and the Five Lakes Conservation Association (FLCA). This is the third year that that the Five Lakes have been involved in aquatic plant management planning through the LARE program.

During the 2007 growing season the following actions were taken.

- May 31 and June 1, 2007: aquatic plant community survey completed on all five lakes.
- June 28, 2007: 10 acres of Eurasian watermilfoil (*Myriophyllum spicatum*) treated within Dallas, Hackenburg, and Messick lakes.
- August 13, 2007: Tier II aquatic plant surveys completed on all five lakes.
- October 13, 2007: Public meeting to discuss aquatic plant survey results and potential treatment.
- November 9, 2007: Meeting between JFNew, the DNR LARE biologist, the aquatic herbicide applicator, and the association representative.

2.0 Watershed and Lake Characteristics

Watershed and lake characteristics are detailed in short form in the initial Indian Lakes Chain Aquatic Plant Management Plan (Weed Patrol, Inc. 2005 Version 2). Additional details regarding the lakes and their watershed can also be found in the Five Lakes Watershed Management Plan (JFNew and DJCase, 2006). These details are not repeated herein with the exception of the following information which remains especially important in describing the aquatic plant community that is present within the Five Lakes and was not fully expressed in the initial aquatic plant management plan.

Residence Time: Each of the Five Lakes possess extremely short residence times. In the case of Dallas Lake, water remains in Dallas Lake for a total of 0.34 years. This means that water enters and leaves Dallas Lake every 124 days, or that all of the water is replaced within Dallas Lake 2.9 times per year. The retention times for the other four lakes are shorter than those calculated for Dallas Lake. Water is replaced within Witmer Lake every 113 days, in Westler Lake every 26 days, in Messick Lake every 10 days, and in Hackenburg Lake every 3.6 days. The extremely short residence times that occur within Hackenburg and Messick Lakes suggests that sustaining herbicide application rates may be difficult within these lakes.

Lake Morphology: All of the lakes possess relatively narrow shelves upon which aquatic plants can grow. The most extreme example is in Westler Lake where water depths reach 10 feet within 10 to

15 feet of the shoreline around much of the lake. As evidenced by the bathymetric maps included in the original aquatic plant management plan, there is a very limited area for aquatic plant growth within Westler Lake. The same holds true for much of Dallas and Witmer lakes as well. Within these three lakes, aquatic plant growth is limited by the area of suitable substrate for plant colonization. In Messick and Hackenburg lakes, shelves are slightly wider than those present in Witmer, Westler, and Dallas lakes; however, plant growth in these lakes is also limited by available substrate.

Water quality: Water quality within the Five Lakes fluctuates with precipitation and available sunlight. The plants present in the lakes typically grow to their fullest extent through May and June, sometimes even into July, before algal blooms cause an initial die back in aquatic plant growth. Conditions observed during the spring and summer assessments indicate that once the water "turns green," plants do not continue to grow within the main bodies of the Five Lakes. In years where water transparency is better through July and August, months when water quality is typically poorest in Indiana lakes, plant growth can become excessive in the Five Lakes. As the quality of water entering the lakes improves through watershed management and water quality improvement project implementation, the aquatic plant community should be reassessed to determine if the plant community increases in growth rate, diversity, or abundance. During 2007, water clarity remained high within the Five Lakes throughout much of the spring and early summer. This resulted in higher density plant growth later in the season than would normally be present within the Five Lakes. Transparency measurements from 2006 and 2007 are detailed in the **Aquatic Plant Community Characterization Section**.

3.0 Lake Uses

See Indian Lakes Chain Aquatic Plant Management Plan (Weed Patrol, draft, 2005).

4.0 Fisheries

No new fisheries information is available since the initial aquatic plant management plan was written.

5.0 Problem Statement

Previous aquatic plant assessments identified the presence of Eurasian watermilfoil as the primary exotic nuisance species located within the Five Lakes. This species continues to be problematic throughout the areas previously identified. However, Eurasian watermilfoil growth appears to be limited by water clarity and substrate availability. Although this plant continues to be present throughout the lakes, it is not present in such high densities as to limit recreation or use of the lakes. Efforts to control this species within areas of heavy boat traffic or high usage should occur within the next year. These lakes should be targeted for reassessment in the future to determine whether watershed improvements have positively impacted water quality within the lakes. If water quality significantly improves, then nuisance plant growth could occur throughout the growing season rather than be limited to the spring and early summer. The plant community present within the Five Lakes should be observed to determine if changes occur.

6.0 Aquatic Vegetation Management Goals and Objectives

The Five Lakes Conservation Association identified three management goals during the development of their initial aquatic plant management plan (Weed Patrol, 2004). These goals fit into the three goals developed by the IDNR for aquatic plant communities within Indiana lakes. The goals originally developed for the Five Lakes are as follows:

1. Develop and maintain a stable, diverse aquatic plant community that supports a good balance of predator and pretty fish and wildlife species, good water quality and is resistant to minor habitat disturbances and invasive species.
2. Direct efforts to preventing and/or controlling the negative impacts of invasive aqutic plant species.
3. Provide reasonable public recreational access while minimizing the negative impacts on plant, fish, and wildlife resources.

No specific objectives were determined at the time that these goals were developed; therefore, specific objectives for the future management of the Five Lakes aquatic plant community are detailed in the **Integrated Management Action Strategy Section** of this report.

7.0 Management History

7.1 Watershed Management

Historic watershed management efforts within the Five Lakes watershed include completion of project feasibility and design for multiple projects, implementation of a sediment retention basin and grade control within the lakes' main inlet, Little Elkhart Creek, and finalization of a watershed management plan. During 2007, the Five Lakes Conservation Association continued these efforts and began work on a design study targeting multiple projects within the Five Lakes watershed. Specifically, these projects include identification of shoreline stabilization needs along the Five Lakes' shoreline and completion of a shoreline stabilization demonstration project; creation of a sediment pond and bank stabilization along Little Elkhart Creek; and identification of and recommendations for storm drains around the lake. With the exception of the shoreline stabilization demonstration project, these projects were not implemented in 2007.

7.2 Aquatic Plant Management

Approximately 10 acres of Eurasian watermilfoil was treated in Dallas, Hackenburg, and Messick lakes in 2007 using LARE funds (Figure 1). Eurasian watermilfoil was treated on June 28, 2007 using 2,4-D at a rate of 5 to 8 gallons per acre, depending on depth (Jim Donahoe, Aquatic Weed Control, personal communication). Treatment was relatively effective with little Eurasian watermilfoil observed in the treated areas during the August plant survey.

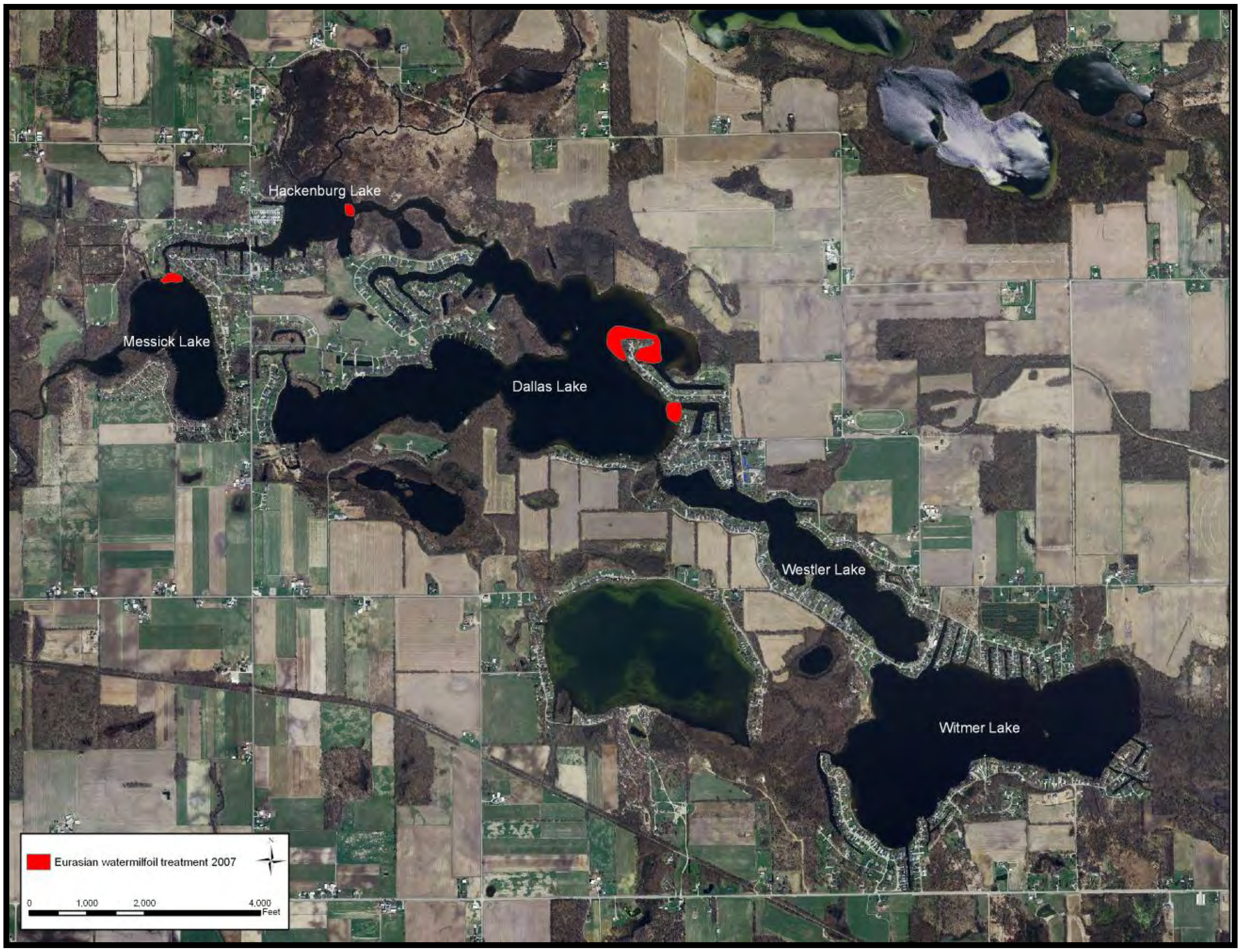

Figure 1. Locations of Eurasian watermilfoil treated with 2,4-D on June 28, 2007.

Additionally, several permits were issued for treatment of channels or near-shore areas around the lakes. These included:

- Treatment of a total of 10.1 acres of Witmer Lake targeting coontail, sago pondweed, common elodea, filamentous algae, chara, curly-leaf pondweed, southern naiad, Eurasian watermilfoil, eel grass, and white water lily. Plants were treated with a combination of Reward, copper sulfate, Cygnet plus, Hydrothal 191, Komeen, and Cleargate.
- Treatment of 5.79 acres of Westler Lake targeting Eurasian watermilfoil, curly-leaf pondweed, sago pondweed, coontail, filamentous algae, chara, common elodea and large-leaf pondweed using Reward, copper sulfate, Hydrothal 191, Cygnet plus, Komeen, and Cleargate.
- Treatment of 20.7 acres of Dallas Lake. Treatment targeted Eurasian watermilfoil, variable-leaf pondweed, spiny naiad, Illinois pondweed, southern naiad, northern watermilfoil, curly-leaf pondweed, filamentous algae, coontail, large-leaf pondweed, floating leaf pondweed, chara, and sago pondweed, using Reward, copper sulfate, Aquathal K, Hydrothal 191, Cygnet plus, and Renovate or 2,4-D.
- Within Hackenburg Lake, treatment targeted nearly 5.9 acres of Eurasian watermilfoil, chara, filamentous algae, coontail, Illinois pondweed, variable-leaf pondweed, large-leaf pondweed, curly-leaf pondweed, using Reward, copper sulfate, Aquathal K, Hydrothal 191, Cygnet plus, and Renovate or 2,4-D.

- In Messick Lake, chara, coontail, Eurasian watermilfoil, spiny naiad, Illinois pondweed, southern naiad, and northern watermilfoil were targeted for treatment on less than 1 acre using Renovate or 2,4-D for spot treatment for selective control of Eurasian watermilfoil.

8.0 Aquatic Plant Community Characterization

8.1 Methods

JFNew surveyed the Five Lakes on May 31, June 1, and August 12, 2007 according to the Indiana Department of Natural Resources sampling protocols (IDNR, 2007). JFNew examined the entire littoral zone of the lake during each of the assessments. Aquatic plant community surveys and exotic species mapping occurred on May 31 and June 1, 2007. The entire littoral zone was surveyed during this assessment. As defined in the DNR protocol, the lake's littoral zone was estimated to be approximately three times the lake's Secchi disk depth. This estimate approximates the 1% light level, or the level at which light penetration into the water column is sufficient to support plant growth. Table 1 details the 2007 spring and summer Secchi disk transparencies and estimated littoral zones. For comparison purposes, the 2006 spring and summer transparencies are also listed in Table 1.

Table 1. Spring and summer transparency measurements for 2006 and 2007 and estimated theoretical littoral zones for 2007 as determined May 31, June 1, and August 13, 2007.

Lake	2006 Spring/Summer Transparency	Spring 2007 Transparency	Estimated Spring 2007 Littoral Zone	Summer 2007 Transparency	Estimated Summer 2007 Littoral Zone
Witmer	3.5 feet/1.2 feet	16.5feet	49.5 feet	5.5 feet	16.5 feet
Westler	4.0 feet/2.0 feet	14.5 feet	33 feet*	4.8 feet	14.4 feet
Dallas	4.0 feet/3.0 feet	10.5 feet	31.5 feet	5.0 feet	15.0 feet
Hackenburg	6.0 feet/3.3 feet	9.8 feet	29.4 feet	5.5 feet	16.5 feet
Messick	7.5 feet/3.0 feet	14.3 feet	42.9 feet	4.5 feet	13.5 feet

*Maximum lake depth

JFNew completed one Tier II survey within each of the Five Lakes. These occurred on August 13, 2007. Surveys were completed using the Tier II survey protocol updated by the IDNR LARE staff in May 2007 (IDNR, 2007). The survey protocol generally follows previous Tier II protocols and requires that the sampling points be stratified over the entire depth of the lake's littoral zone. Sampling points used during this survey are the same as those used during he 2006 Tier II surveys. Total points sampled per stratum were determined as follows:

1. Appendix D of the IDNR protocol was consulted to determine the number of points to be sampled. This determination was based on the lake size (surface area) and trophic status.
2. Table 3 of the IDNR protocol was referenced as an indicator of the number of sample points per stratum. Table 2 (below) lists the sampling strategy for the Five Lakes.

Stratum refers to depth at which plants were observed. Dominance presented in subsequent tables was calculated by the IDNR protocol. The density scale presented in subsequent tables provides a measure of the density of a species. The percentage of plants found within a density measure indicates the frequency of plants found over all the sampling points.

Table 2. Tier II sampling strategy for the Five Lakes using the 2007 Tier II protocol.

Lake	Size	Trophic Status	Number of Points	Stratification of Points
Witmer Lake	204 acres	Hypereutrophic	60	50 pts 0-5 foot stratum 10 pts 5-10 foot stratum
Westler Lake	88 acres	Eutrophic	40	17 pts 0-5 foot stratum 13 pts 5-10 foot stratum 10 pts 10-15 foot stratum
Dallas Lake	283 acres	Mesotrophic	60	30 pts 0-5 foot stratum 20 pts 5-10 foot stratum 10 pts 10-15 foot stratum
Hackenburg Lake	42 acres	Eutrophic	30	10 pts 0-5 foot stratum 10 pts 5-10 foot stratum 10 pts 10-15 foot stratum
Messick Lake	68 acres	Eutrophic	40	17 pts 0-5 foot stratum 13 pts 5-10 foot stratum 10 pts 10-15 foot stratum

8.2 2007 Sampling Results

A spring plant community survey and a summer Tier II survey were completed on all five lakes (Witmer, Westler, Dallas, Hackenburg, and Messick). All surveys were conducted in 2007 by JFNew. The survey schedule for all lakes is detailed in Table 3. No species were sent to and outside taxonomist for vouchering or identification. Additionally, no threatened or rare aquatic plant species were collected during the surveys.

Table 3. Survey schedule of Tier I and II surveys.

Survey	Date
Spring community survey	May 31 and June 1, 2007
Summer community survey	August 13, 2007
Summer Tier II	August 13, 2007

8.2.1 Five Lakes Plant Community Survey

Several areas were mapped as containing relatively dense Eurasian watermilfoil growth during the spring survey (Figure 2). However, most of these areas were sparsely vegetated during the summer assessment. Declines in water clarity, increased runoff from the watershed, and denser algal growth likely limited the plant community density and diversity during the summer plant survey. Based on this assessment and information from the 2006 assessment, JFNew determined that plant growth is typically limited by water quality. Therefore, when lake peak usage periods typically occur, aquatic plant growth within the main body of the Five Lakes is declining. This results in most areas which could be treated for dense plant growth within the early summer containing relatively sparse aquatic plant communities during the summer assessment.

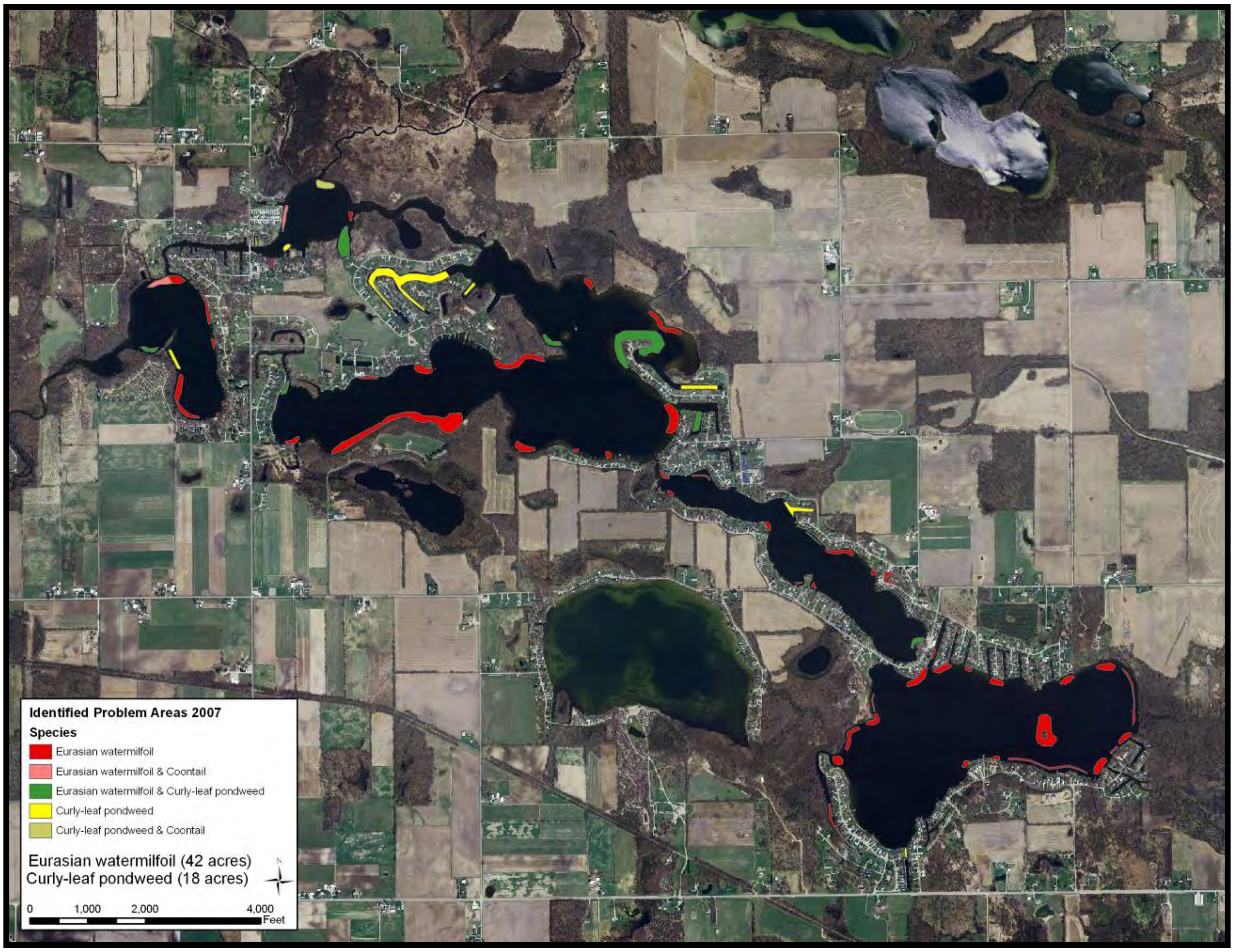

Figure 2. Dense curly-leaf pondweed and Eurasian watermilfoil locations identified within the Five Lakes during the 2007 assessments.

During the spring assessment, Witmer Lake contained several relatively dense Eurasian watermilfoil beds. Most of these areas were located along the undeveloped east and west ends of the lake, around the island, and within or at the mouth of the lake's channels. Although Eurasian watermilfoil dominated the aquatic plant community within Witmer Lake, several other species were also identified (Table 4). Only four of these species are submerged species and include Eurasian watermilfoil, northern watermilfoil, large-leaf pondweed, and coontail. Ten emergent or rooted floating species were identified during the survey including two exotic species: purple loosestrife and reed canary grass. During the summer survey, eight submerged species were observed including those listed above as well as Illinois pondweed, grassy pondweed, sago pondweed, and musk grass. Despite the increased diversity, the density of the plant community was lower than that observed during the spring survey. However, given the relatively good water clarity present within Witmer Lake, typical declines in Eurasian watermilfoil populations along the east end of the lake were not observed in 2007. Populations throughout much of the rest of the lake did decline as per normal conditions. Overall, the increase in algal density and decrease in water transparency limits aquatic plant growth in Witmer Lake. Likewise, this balance limits the need for aquatic herbicide to reduce Eurasian watermilfoil populations within Witmer Lake.

Table 4. Aquatic plant species observed in Witmer Lake during the spring and summer surveys completed May 31 and August 13, 2007.

Scientfic Name	Common Name	Spring	Summer
Acer saccharinum	Silver maple (E)		X
Asclepias incarnata	Swamp milkweed (E)		X
Cephalanthus occidentalis	Buttonbush (E)		X
Ceratophyllum demersum	Coontail (S)	X	X
Chara species	Musk grass species (S)		X
Cornus obliqua	Blue-fruited dogwood (E)		X
Carex stricta	Common tussock sedge (E)		X
Decodon verticillatus	Whirled loosestrife (E)		X
Eupatorium perfoliatum	Common boneset (E)		X
Filamentous algae	Filamentous algae (A)		X
Ilex verticillata	Common winterberry (E)		X
Iris virginica	Blue-flag iris (E)		X
Leersia oryzoides	Rice cutgrass (E)		X
Lemna minor	Common duckweed (NF)		X
Lemna trisulca	Star duckweed (NF)		X
Lythrum salicaria	Purple loosestrife (E)	X	X
Myriophyllum exalbescens	Northern watermilfoil (S)	X	X
Myriophyllum heterophyllum	Various-leaf watermilfoil (S)		X
Myriophyllum spicatum	Eurasian watermilfoil (S)	X	X
Nuphar advena	Spatterdock (RF)	X	X
Nuphar variegatum	Bullhead lily (RF)		X
Nymphaea tuberosa	White water lily (RF)	X	X
Peltandra virginica	Arrow arum (E)		X
Phalarus arundinacea	Reed canary grass (E)	X	X
Polygonum amphibium stipulaceum	Water knotweed (E)		X
Pontedaria cordata	Pickerel weed (E)	X	X
Potamogeton amplifolius	Large-leaf pondweed (S)	X	X
Potamogeton gramineus	Grassy pondweed (S)		X
Potamogeton illinoensis	Illinois pondweed (S)		X
Rosa palustris	Swamp rose (E)		X
Sagittaria latifolia	Common arrowhead (E)	X	
Saururus cernuus	Lizard's tail (E)		X
Scirpus acutus	Hard-stemmed bulrush (E)	X	X
Scirpus pungens	Chairmaker's bulrush (E)	X	X
Spirodela polyrhiza	Large duckweed (NF)		X
Stuckenia pectinatus	Sago pondweed (S)	X	X
Typha latifolia	Broad-leaf cattail (E)	X	X
Wolffia columbiana	Water meal (NF)		X

A = Alga, E = Emergent, NF = Non-rooted floating, RF = Rooted floating, S = Submergent

The plant species in Westler Lake that occurs in greatest abundance is Eurasian watermilfoil. However, Eurasian watermilfoil growth is limited by the narrow shelf around the margin of the lakeshore. Only four submerged species were identified in Westler Lake during the spring survey. These included Eurasian watermilfoil, curly-leaf pondweed, large-leaf pondweed, and coontail. The plant bed, which encircles Westler Lake, is relatively narrow and extends out into the lake at variable distances ranging from 25-125 feet. Like Witmer Lake, Westler Lake possessed several areas that were mapped as possessing dense Eurasian watermilfoil communities during the spring assessment. However, poor transparency, algal growth, and water depth limited plant growth during the summer assessment. Again, data suggest that Eurasian watermilfoil growth is controlled by water clarity and limited control through herbicide application is necessary at this time.

Table 5. Aquatic plant species observed in Westler Lake during the spring and summer surveys completed May 31 and August 13, 2007.

Scientific Name	Common Name	Spring	Summer
Ceratophyllum demersum	Coontail (S)		X
Cornus obliqua	Blue-fruited dogwood (E)	X	X
Filamentous algae	Filamentous algae (A)	X	X
Iris virginica	Blue-flag iris (E)		X
Lemna minor	Common duckweed (NF)	X	X
Lippia lanceolata	Fog fruit (E)		X
Lysimachia nummularia	Moneywort (E)		X
Lythrum salicaria	Purple loosestrife (E)	X	X
Myriophyllum spicatum	Eurasian watermilfoil (S)	X	X
Najas guadalupensis	Southern naiad (S)		X
Nuphar advena	Spatterdock (RF)	X	X
Nuphar variegatum	Bullhead lily (RF)		X
Nyphaea tuberosa	White water lily (RF)	X	X
Peltandra virginica	Arrow arum (E)	X	X
Phalarus arundinacea	Reed canary grass (E)		X
Polygonum coccineum	Water heartsease (S)		X
Polygonum lapathifolium	Heartsease (S)		X
Pontedaria cordata	Pickerel weed (E)	X	X
Potamogeton amplifolius	Large-leaf pondweed (S)	X	X
Potamogeton crispus	Curly-leaf pondweed (S)	X	
Potamogeton gramineus	Grassy pondweed (S)		X
Spirodela polyrhiza	Large duckweed (NF)		X
Stuckenia pectinatus	Sago pondweed (S)	X	X
Typha angustifolia	Narrow-leaf cattail (E)	X	X
Typha X glauca	Blue cattail (E)	X	X
Typha latifolia	Broad-leaf cattail (E)	X	X

A = Alga, E = Emergent, NF = Non-rooted floating, RF = Rooted floating, S = Submergent

Like Witmer and Westler lakes, the main plant species occurring in Dallas Lake is Eurasian watermilfoil. Other plant species present in high abundance and frequency include: spatterdock, white water lily, arrow arum, curly-leaf pondweed, grass-leaf pondweed, Illinois pondweed, and sago pondweed. The plant beds hug the shoreline and extend out into the lake at variable distances ranging from 50-300 feet. Several problem areas are located throughout the lake. Eurasian watermilfoil is present in dense patches throughout Dallas Lake; however, no particular pattern is apparent in the growth of this species. Like lakes upstream of Dallas Lake in the Five Lakes Chain, water clarity limits the growth of Eurasian watermilfoil during the summer peak usage period within Dallas Lake. Only those areas deemed as heavy boating areas where Eurasian watermilfoil is a nuisance or could easily or rapidly spread to other portions of the lake should be considered for treatment at this time.

Table 6. Aquatic plant species observed in Dallas Lake during the spring and summer surveys completed May 31 and August 13, 2007.

Scientific Name	Common Name	Spring	Summer
Acer saccharinum	Silver maple (E)		X
Cephalanthus occidentalis	Buttonbush (E)		X
Ceratophyllum demersum	Coontail (S)	X	X
Cornus obliqua	Blue-fruited dogwood (E)		X
Decodon verticillatus	Whirled loosestrife (S)	X	
Filamentous algae	Filamentous algae (A)		X
Fraxinus pennsylvanica	Green ash (E)		X
Heteranthera dubia	Water star grass (E)		X
Iris virginica	Blue-flag iris (E)	X	
Myriophyllum heterophyllum	Various-leaf watermilfoil (S)		X
Myriophyllum spicatum	Eurasian watermilfoil (S)	X	X
Najas guadalupensis	Southern naiad (S)		X
Nuphar advena	Spatterdock (RF)	X	X
Nyphaea tuberosa	White water lily (RF)	X	X
Peltandra virginica	Arrow arum (E)		X
Phalarus arundinacea	Reed canary grass (E)		X
Phragmites australis	Common reed (E)		X
Pontedaria cordata	Pickerel weed (E)	X	X
Potamogeton amplifolius	Large-leaf pondweed (S)	X	X
Potamogeton crispus	Curly-leaf pondweed (S)	X	
Potamogeton gramineus	Grassy pondweed (S)	X	
Potamogeton illinoensis	Illinois pondweed (S)	X	X
Potamogeton nodosus	Long-leaf pondweed (S)		X
Potamogeton robbinsii	Robbin's pondweed (S)	X	
Scirpus acutus	Hard-stem bulrush (E)		X
Scirpus pungens	Chairmaker's rush (E)	X	X
Stuckenia pectinatus	Sago pondweed (S)	X	X
Typha angustifolia	Narrow-leaf cattail (E)		X
Typha latifolia	Broad-leaf cattail (E)	X	

A = Alga, E = Emergent, NF = Non-rooted floating, RF = Rooted floating, S = Submergent

The main plant species occurring in Hackenburg Lake are coontail and filamentous algae. Other plant species present in high frequency in both surveys include: Eurasian watermilfoil, spatterdock, white water lily, arrow arum, large-leaf pondweed, curly-leaf pondweed, Illinois pondweed, and sago pondweed. The plant beds hug the shoreline and extend out into the lake at variable distances ranging from 50-300 feet. A problem area is located in the southeastern lobe of the lake and at the mouth of the channel connecting Hackenburg Lake with Dallas Lake where Eurasian watermilfoil is relatively dense. Coontail and filamentous algae dominate the aquatic plant community within Hackenburg Lake. Therefore, only the area where boating through Eurasian watermilfoil beds could cause nuisance conditions within the Five Lakes is recommended for treatment at this time.

Table 7. Aquatic plant species observed in Hackenburg Lake during the spring and summer surveys completed June 1 and August 13, 2007.

Scientific Name	Common Name	Spring	Summer
Acer saccharinum	Silver maple (E)		X
Ceratophyllum demersum	Coontail (E)	X	X
Chara species	Musk grass species (S)		X
Cornus obliqua	Blue-fruited dogwood (E)		X
Decodon verticillatus	Whirled loosestrife (E)		X
Filamentous algae	Filamentous algae (A)	X	X
Fraxinus pennsylvanica	Green ash (E)		X
Leersia oryzoides	Rice cutgrass (E)		X
Iris virginica	Blue-flag iris (E)		**X**
Lemna minor	Common duckweed (NF)		X
Lippia lanceolata	Fog fruit (E)		X
Lythrum salicaria	Purple loosestrife (E)		X
Myriophyllum spicatum	Eurasian watermilfoil (S)	X	X
Nuphar advena	Spatterdock (RF)	X	X
Nuphar variegatum	Bullhead lily (RF)		X
Nymphaea tuberosa	White water lily (RF)	X	X
Peltandra virginica	Arrow arum (E)		X
Phalarus arundinacea	Reed canary grass (E)		X
Polygonum hydropiperoides	Mild water pepper (S)		X
Pontedaria cordata	Pickerel weed (S)	X	X
Potamogeton amplifolius	Large-leaf pondweed (S)	X	
Potamogeton berchtoldii	Broad-leaf small pondweed (S)		X
Potamogeton crispus	Curly-leaf pondweed (S)	X	
Potamogeton gramineus	Grassy pondweed (S)	X	X
Potamogeton illinoensis	Illinois pondweed (S)	X	X
Sagittaria latifolia	Common arrowhead (E)	X	
Scirpus acutus	Hard-stemmed bulrush (E)		X
Scirpus validus	Soft-stem bulrush (E)		X
Sparganium species	Burreed species (E)		X
Stuckenia pectinatus	Sago pondweed (S)	X	X

Scientific Name	Common Name	Spring	Summer
Typha angustifolia	Narrow-leaf cattail (E)		X
Typha latifolia	Broad-leaf cattail (E)		X
Utricularia vulgaris	Common bladderwort (S)		X
Wolffia columbiana	American water meal (NF)		X

A = Alga, E = Emergent, NF = Non-rooted floating, RF = Rooted floating, S = Submergent

The main plant species occurring in Messick Lake is coontail. Other plant species present in high frequency in both surveys include: Eurasian watermilfoil, filamentous algae, spatterdock, white water lily, arrow arum, curly-leaf pondweed, and Illinois pondweed. The plant bed hugs the shoreline and extends out into the lake at variable distances ranging from 50-300 feet. The plant bed fills the entire southwestern lobe of Messick Lake. A problem area is located along the center of the northern shoreline where Eurasian watermilfoil remains particularly dense within Messick Lake. However, like the other lakes in the Five Lakes Chain, water clarity, water depth, and algal growth limited Eurasian watermilfoil density within Messick Lake during the summer survey. This results in limited Eurasian watermilfoil growth which makes the use of herbicide unnecessary except in areas where boating through exotic species beds could spread fragments of Eurasian watermilfoil.

Table 8. Aquatic plant species observed in Messick Lake during the spring and summer surveys completed June 1 and August 13, 2007.

Scientific Name	Common Name	Spring	Summer
Ceratophyllum demersum	Coontail (S)	X	X
Decodon verticillatus	Whirled loosestrife (E)	X	X
Filamentous algae	Filamentous algae (A)		X
Lobelia cardinalis	Cardinal flower (E)		X
Lythrum salicaria	Purple loosestrife (E)		X
Myriophyllum spicatum	Eurasian watermilfoil (S)	X	X
Najas guadalupensis	Southern naiad (S)		X
Najas marina	Spiny naiad (S)		X
Nuphar advena	Spatterdock (RF)	X	X
Nyphaea tuberosa	White water lily (RF)	X	X
Peltandra virginica	Arrow arum (E)	X	X
Pontedaria cordata	Pickerel weed (S)	X	X
Potamogeton amplifolius	Large-leaf pondweed (S)	X	X
Potamogeton crispus	Curly-leaf pondweed (S)	X	
Potamogeton foliosis	Narrow-leaf pondweed (S)		X
Potamogeton gramineus	Grassy pondweed (S)	X	X
Potamogeton illinoensis	Illinois pondweed (S)	X	X
Potamogeton natans	Common pondweed (S)		X
Potamogeton robbinsii	Robbin's pondweed (S)	X	X
Scirpus acutus	Hard-stem bulrush (E)		X
Scirpus pungens	Chairmaker's rush (E)		X
Sparganium eurycarpum	Common burreed (E)		X

Scientific Name	Common Name	Spring	Summer
Stuckenia pectinatus	Sago pondweed (S)	X	X
Typha angustifolia	Narrow-leaf cattail (E)		X
Typha latifolia	Broad-leaf cattail (E)		X

A = Alga, E = Emergent, NF = Non-rooted floating, RF = Rooted floating, S = Submergent

Overall, plant growth within the Five Lakes is relatively dense in the spring, but lacks the diversity observed in the summer survey. Aquatic plants generally cover much of the shoreline of all five lakes. Growth is typically limited by the width of available substrate located within the littoral zone. This is especially true within Witmer, Westler, and Dallas lakes. Each of these lakes possesses a narrow shelf upon which plants can grow. Plants typically colonize all available surfaces early in the spring and grow to peak densities in June or July. However, densities decline as water quality become poorer. When clarity declines and algal densities increase, aquatic plants within the Five Lakes are shaded out and are therefore unable to photosynthesize. When this occurs, plants drop out of the water column and densities become much more sparse. This is readily apparent when looking at the survey data. Submergent plant densities typically declined from the spring to summer surveys. During 2007, the water clarity declined during the summer but did not reach the poor levels commonly observed within the lakes during the summer months. Nonetheless, aquatic plant density declined throughout much of the lake as is typical of the growth pattern present in the Five Lakes Chain.

8.2.2 Tier II

The Tier II surveys occurred on Witmer, Westler, Dallas, Hackenburg, and Messick lakes on August 13, 2007. Figure 3 shows the locations where points were sampled within all five lakes. Figure 4 identifies locations of the exotic species, Eurasian watermilfoil, found during the Tier II sampling events. Raw data are included in Appendix A, while Appendix B contains complete survey results for each lake.

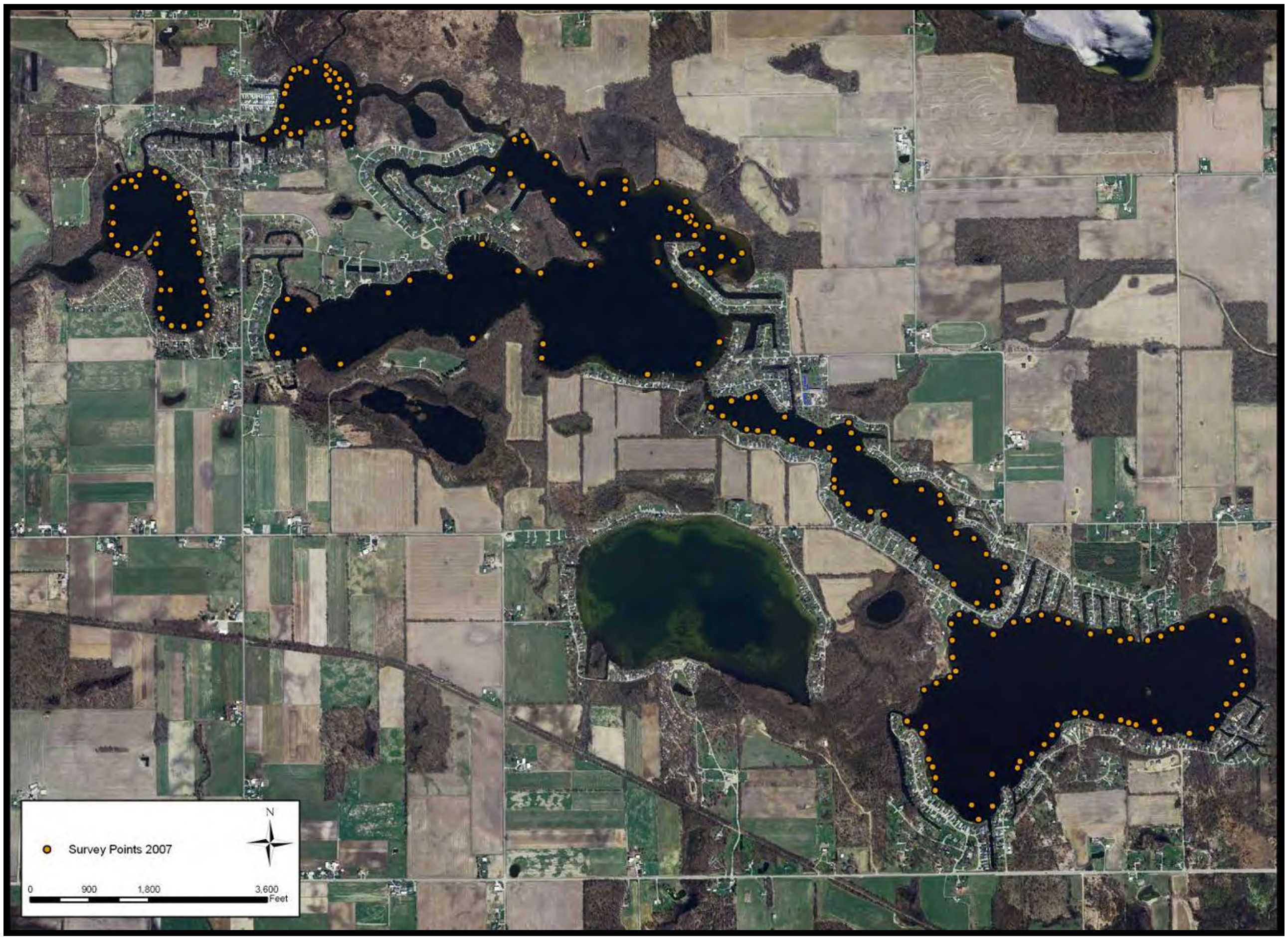

Figure 3. Locations sampled during the Five Lakes Tier II survey as sampled which occurred on August 13, 2007.

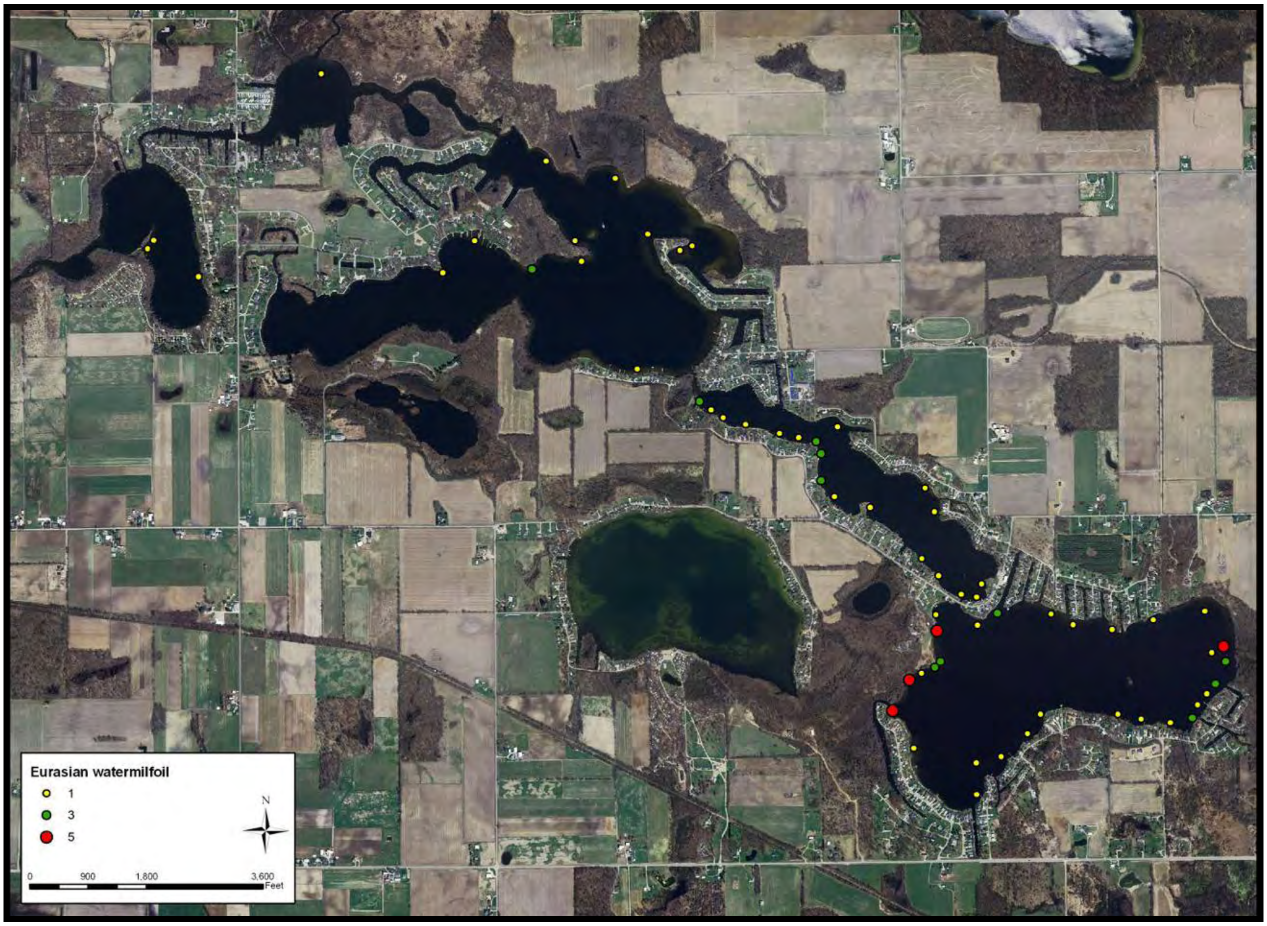

Figure 4. Eurasian watermilfoil locations in the Five Lakes as sampled during the Tier II surveys which occurred on August 13, 2007.

Witmer Lake

JFNew conducted the Tier II survey on Witmer Lake on August 13, 2007. Transparency was measured at the deepest spot in the lake using a Secchi disk prior to the sampling event. Transparency was observed at 5.5 feet at the time of the survey. Based on the survey protocol, plants were sampled to a depth of 10 feet. However, plants were only present to a maximum depth of 9 feet. Sixty sites were randomly selected within the littoral zone based on the stratification indicated in the protocol. Results of the sampling are listed in Table 9 and Appendix B.

Table 9. Witmer Lake summer Tier II survey metrics and data as collected August 13, 2007.

Total Sites:	60	Mean species / site:	0.7167	Native diversity:	0.817
Littoral Sites:	58	Maximum species / site:	4	Species diversity:	0.496
Littoral Depth (ft):	10	Number of species:	9	SE Mean natives / site:	0.076
Date:	8/13/07	Littoral sites with plants:	35	Mean natives / site:	0.217
Lake:	Witmer	Secchi(ft):	5.5	SE Mean species / site:	0.098

All depths (0-10')		**Frequency of Occurrence**	**Frequency per Species**				**Dominance**
Scientific Name	**Common Name**		**0**	**1**	**3**	**5**	
Myriophyllum spicatum	Eurasian watermilfoil	50.00	50.00	33.33	10.00	6.67	19.33
Chara species	Musk grass species	1.67	98.33	0.00	0.00	1.67	1.67
Ceratophyllum demersum	Coontail	6.67	93.33	6.67	0.00	0.00	1.33
Myriophyllum exalbescens	Northern watermilfoil	5.00	95.00	5.00	0.00	0.00	1.00
Potamogeton zosteriformes	Flat-stem pondweed	1.67	98.33	1.67	0.00	0.00	0.33
Potamogeton illinoensis	Illinois pondweed	1.67	98.33	1.67	0.00	0.00	0.33
Potamogeton gramineus	Grassy pondweed	1.67	98.33	1.67	0.00	0.00	0.33
Potamogeton amplifolius	Large-leaf pondweed	1.67	98.33	1.67	0.00	0.00	0.33
Najas guadalupensis	Southern naiad	1.67	98.33	1.67	0.00	0.00	0.33
Filamentous algae	Filamentous algae	8.33					

Eurasian watermilfoil dominated the plant community throughout the littoral zone and within each stratum. Eurasian watermilfoil was identified at 50% of sites surveyed throughout Witmer Lake. It was also the most frequently identified plant species in the 0-5 foot and 5-10 foot strata where it was also observed at 50% of sites. Overall, Eurasian watermilfoil dominated the plant community and was present at more than 10 times the dominance of other plants throughout the littoral zone and at 10 times the dominance in the 0-5 foot stratum. Furthermore, Eurasian watermilfoil was one of only two aquatic plant species identified within the 5-10 foot stratum. This species, with a dominance of 12.5, was found at 50% of points surveyed in this stratum. Coontail and northern watermilfoil were also identified relatively frequently occurring at 6.7% and 5% of sites, respectively. However, both species were present in relatively low density with dominances less than two. All other plant species were present in low abundance.

Westler Lake

The Tier II survey on Westler Lake was conducted on August 13, 2007. Transparency was measured at the deepest spot in the lake using a Secchi disk prior to the sampling event. Transparency was found to be 4.8 feet at the time the survey was conducted. Based on the survey protocol, plants were sampled to a depth of 15 feet. Plants were present throughout the entire sampled water column. Forty sites were randomly selected within the littoral zone based on the stratification indicated in the protocol. Results of the sampling are listed in Table 10 and Appendix B.

Table 10. Westler Lake summer Tier II survey metrics and data as collected August 13, 2007.

Total Sites:	40	Mean species / site:	0.632	Native diversity:	0.778
Littoral Sites:	38	Maximum species / site:	2	Species diversity:	0.424
Littoral Depth (ft):	15	Number of species:	6	SE Mean natives / site:	0
Date:	8/13/07	Littoral sites with plants:	21	Mean natives / site:	0.158
Lake:	Westler	Secchi(ft):	4.8	SE Mean species / site:	6

All depths (0-15')		**Frequency of Occurrence**	**Frequency per Species**				**Dominance**
Scientific Name	**Common Name**		**0**	**1**	**3**	**5**	
Myriophyllum spicatum	Eurasian watermilfoil	47.50	52.50	37.50	10.00	0.00	13.50
Potamogeton amplifolius	Large-leaf pondweed	5.00	95.00	5.00	0.00	0.00	1.00
Najas guadalupensis	Southern naiad	5.00	95.00	5.00	0.00	0.00	1.00
Stuckenia pectinatus	Sago pondweed	5.00	95.00	5.00	0.00	0.00	1.00
Ceratophyllum demersum	Coontail	5.00	95.00	5.00	0.00	0.00	1.00
Potamogeton gramineus	Grassy pondweed	2.50	97.50	2.50	0.00	0.00	0.50
Filamentous algae	Filamentous algae	27.50					

Like Witmer Lake, Eurasian watermilfoil was the most frequent plant species present in Westler Lake. Eurasian watermilfoil was identified at 47.5% of sites sampled throughout the lake and at 56% of sites in the 0-5 foot stratum, 53% of sites in the 5-10 foot stratum, and 22% of sites in the 10-15 foot stratum. Eurasian watermilfoil was also more dominant (13.5) than other species present in the lake compared with other species (≤1). Six other species were identified during the Tier II survey; however, these species were present in relatively low density and frequency. Large-leaf pondweed, southern naiad, sago pondweed, and coontail all occurred at 5% of the sites with a dominance of 1. In the 0-5 foot stratum, coontail occurred at the second highest frequency (12.5% of sites; see Appendix B for complete results) behind Eurasian watermilfoil (56% of the sites). However, coontail was absent from the 5-10 foot and 10-15 foot strata. Grassy pondweed, large-leaf pondweed, southern naiad, and sago pondweed occurred at 6.3% of sites in the 0-5 foot stratum and maintained a dominance of 1.25. Large-leaf pondweed, southern naiad, and sago pondweed increased in frequency and dominance in the 5-10 foot stratum occurring at 6.7% of sites with a dominance of 1.33. None of these species wre present in the 10-15 foot stratum where only Eurasian watermilfoil occurred.

Dallas Lake

The Tier II survey on Dallas Lake was conducted August 13, 2007. Transparency was measured at the deepest spot in the lake using a Secchi disk prior to the sampling and was found to be 5 feet. Based on the survey protocol, plants were sampled to a depth of 20 feet. Plants were present to a depth of 12 feet. Sixty sites were randomly selected throughout the littoral zone based on the stratification indicated in the protocol. Results of the sampling are listed in Table 11 and Appendix B.

Table 11. Dallas Lake summer Tier II survey metrics and data as collected August 13, 2007.

Total Sites:	60	Mean species / site:	0.964	Native diversity:	0.848
Littoral Sites:	47	Maximum species / site:	5	Species diversity:	0.862
Littoral Depth (ft):	12	Number of species:	10	SE Mean natives / site:	0
Date:	8/13/07	Littoral sites with plants:	22	Mean natives / site:	0.768
Lake:	Dallas	Secchi(ft):	5.0	SE Mean species / site:	43

All depths (0-15')		**Frequency of Occurrence**	**Frequency per Species**				**Dominance**
Scientific Name	**Common Name**		**0**	**1**	**3**	**5**	
Myriophyllum spicatum	Eurasian watermilfoil	18.33	81.67	16.67	1.67	0.00	4.33
Potamogeton gramineus	Grassy pondweed	16.67	83.33	16.67	0.00	0.00	3.33
Potamogeton illinoensis	Illinois pondweed	13.33	86.67	13.33	0.00	0.00	2.67
Najas marina	Spiny naiad	13.33	86.67	13.33	0.00	0.00	2.67
Chara species	Musk grass species	10.00	90.00	10.00	0.00	0.00	2.00
Ceratophyllum demersum	Coontail	10.00	90.00	10.00	0.00	0.00	2.00
Stuckenia pectinatus	Sago pondweed	6.67	93.33	6.67	0.00	0.00	1.33
Potamogeton amplifolius	Large-leaf pondweed	3.33	96.67	3.33	0.00	0.00	0.67
Utricularia vulgaris	Common bladderwort	1.67	98.33	1.67	0.00	0.00	0.33
Potamogeton zosteriformes	Flat-stem pondweed	1.67	98.33	1.67	0.00	0.00	0.33
Filamentous algae	Filamentous algae	21.67					

Eurasian watermilfoil was the most dominant plant species in Dallas Lake with a site frequency of 18% and the greatest relative and mean densities of any plant species identified in the lake. Grassy pondweed, Illinois pondweed, and spiny naiad were also present in high abundance throughout the lake. In the 0-5 foot stratum, Eurasian watermilfoil was the most dominant plant and possessed the greatest relative (0.22) and mean (1.18) densities of any plant species within this stratum. Grassy pondweed, Illinois pondweed, Eurasian watermilfoil, and spiny naiad were the most frequent and abundant species identified in the 0-5 foot strata with grassy pondweed occurring at 33% of the sites with a dominance of 6.7, Illinois pondweed and spiny naiad occurring at nearly 24% of the sites with a dominance of 4.7, and spiny naiad occurring at nearly 19% of the sites with a dominance of 3.8 (Appendix B). All of these species except Eurasian watermilfoil occurred at less sites in lower density in the 5-10 foot and 10-15 foot strata. In the 0-5 foot stratum, spiny naiad was observed at 16% of sites, while Illinois pondweed and grassy pondweed were present at nearly 11% of sites. In the 10-15 foot stratum, chara dominated the community occurring at 18% of sites, while Illinois pondweed, grassy pondweed, and spiny naiad were co-dominant with sago pondweed, and common bladderwort. All five species occurred at approximately 9% of sites with a dominance of 1.8. With the exception of bladderwort, this was the lowest frequency and dominance observed for these species. Eurasian watermilfoil followed an opposite pattern. This species increased in density occurring at nearly 32% of sites with a dominance of 8.4 in the 5-10 foot stratum. However, Eurasian watermilfoil was absent from the 10-15 foot stratum. Finally, coontail, which occurred relatively infrequently in the 0-5 foot stratum (4.8% of sites with a dominance <1), was the second most frequent species in the 5-10 foot stratum occurring at 26% of sites with a dominance of 5.3. Coontail was absent from the 10-15 foot stratum.

Hackenburg Lake

The Tier II survey on Hackenburg Lake was conducted August 13, 2007. Transparency was measured at the deepest spot in the lake using a Secchi disk prior to completing the survey.

Transparency was found to be 5.5 feet. Based on the survey protocol, plants were sampled to a depth of 15 feet. Plants were present throughout the sampled water column. Thirty sites were randomly selected within the littoral zone based on the stratification indicated in the protocol. Results of the sampling are listed in Table 12 and Appendix B.

Table 12. Hackenburg Lake summer Tier II survey metrics and data as collected August 13, 2007.

Total Sites:	31	Mean species / site:	1.069	Native diversity:	0.573
Littoral Sites:	29	Maximum species / site:	3	Species diversity:	0.599
Littoral Depth (ft):	15	Number of species:	8	SE Mean natives / site:	0
Date:	8/13/07	Littoral sites with plants:	21	Mean natives / site:	1.034
Lake:	Hackenburg	Secchi(ft):	5.5	SE Mean species / site:	30

All depths (0-15')		**Frequency of Occurrence**	**Frequency per Species**				**Dominance**
Scientific Name	**Common Name**		**0**	**1**	**3**	**5**	
Ceratophyllum demersum	Coontail	67.74	32.26	41.94	16.13	9.68	27.74
Potamogeton gramineus	Grassy pondweed	9.68	90.32	9.68	0.00	0.00	1.94
Utricularia vulgaris	Common bladderwort	6.45	93.55	6.45	0.00	0.00	1.29
Stuckenia pectinatus	Sago pondweed	6.45	93.55	6.45	0.00	0.00	1.29
Chara species	Musk grass species	6.45	93.55	6.45	0.00	0.00	1.29
Potamogeton illinoensis	Illinois pondweed	3.23	96.77	3.23	0.00	0.00	0.65
Potamogeton berchtoldii	Broad-leaf small pondweed	3.23	96.77	3.23	0.00	0.00	0.65
Myriophyllum spicatum	Eurasian watermilfoil	3.23	96.77	3.23	0.00	0.00	0.65
Filamentous algae	Filamentous algae	100.00					

Coontail dominated the plant community throughout Hackenburg Lake. This species was found at the highest percentage of sampling sites (68%) and also had the highest relative and mean densities and dominance (27.7). Coontail occurred nearly seven times more often than the next most-frequent species, grassy pondweed, which occurred at approximately 10% of the sites. Coontail was also much more dominant than grassy pondweed, which possessed a dominance of 1.9. Common bladderwort, sago pondweed, and chara were relatively frequent occurring at 6.5% of the sites; however, these species were relatively sparse with a dominance of only 1.3. Eurasian watermilfoil occurred at only 3% of the sites with a dominance less than 1.

In the 0-5 foot stratum, coontail occurred at 63% of the sites with a dominance of 27.3 (Appendix B). Common bladderwort, Illinois pondweed, grassy pondweed, and chara were the only other species identified in this stratum and occurred at 9.1% of the sites with a dominance of 1.8. Coontail, sago pondweed, and grassy pondweed increased in dominance and frequency from the 0-5 foot stratum to the 5-10 foot stratum. Coontail occurred with its highest frequency (76% of the sites) and dominance (36.9) occurring in the 5-10 foot stratum. Sago and grassy pondweeds occurred at 15.4% of the sites with a dominance of 3.1. Common bladderwort, Eurasian watermilfoil, and chara were present at nearly 7.7% of the sites, but were present in relatively low dominance (1.5). Only coontail was present in the 10-15 foot stratum.

Messick Lake

The Tier II survey on Messick Lake was conducted on August 13, 2007. Transparency was measured at the deepest spot in the lake using a Secchi disk prior to sampling event. Transparency was found to be 4.5 feet during the survey. This transparency was the poorest of any of the Five Lakes during the assessment. Based on the survey protocol, plants were sampled to a depth of 15 feet. Plants were present to a depth of 10 feet. Forty sites were randomly selected within the littoral zone based on the stratification indicated in the protocol. Results of the sampling are listed in Table 13 and Appendix B.

Table 13. Messick Lake summer Tier II survey metrics and data as collected August 13, 2007.

Total Sites:	40	Mean species / site:	1.086	Native diversity:	0.815
Littoral Sites:	27	Maximum species / site:	4	Species diversity:	0.837
Littoral Depth (ft):	10	Number of species:	9	SE Mean natives / site:	0
Date:	8/13/07	Littoral sites with plants:	19	Mean natives / site:	1
Lake:	Messick	Secchi(ft):	4.5	SE Mean species / site:	35

All depths (0-15')		**Frequency of Occurrence**	**Frequency per Species**				**Dominance**
Scientific Name	**Common Name**		**0**	**1**	**3**	**5**	
Ceratophyllum demersum	Coontail	27.50	72.50	27.50	0.00	0.00	5.50
Stuckenia pectinatus	Sago pondweed	20.00	80.00	20.00	0.00	0.00	4.00
Potamogeton illinoensis	Illinois pondweed	12.50	87.50	10.00	2.50	0.00	3.50
Potamogeton gramineus	Grassy pondweed	12.50	87.50	12.50	0.00	0.00	2.50
Potamogeton amplifolius	Large-leaf pondweed	10.00	90.00	10.00	0.00	0.00	2.00
Myriophyllum spicatum	Eurasian watermilfoil	7.50	92.50	7.50	0.00	0.00	1.50
Najas guadalupensis	Southern naiad	5.00	95.00	5.00	0.00	0.00	1.00
Potamogeton natans	Floating-leaf pondweed	2.50	97.50	2.50	0.00	0.00	0.50
Potamogeton foliosis	Leafy pondweed	2.50	97.50	2.50	0.00	0.00	0.50
Najas marina	Spiny naiad	2.50	97.50	2.50	0.00	0.00	0.50
Filamentous algae	Filamentous algae	60.00					

Coontail dominated the plant community throughout the water column. Coontail was found at approximately 28% of the sampled sites and possessed the greatest dominance (5.5) of any plants identified within Messick Lake. Sago pondweed occurred at 20% of the sites, while Illinois and grassy pondweed were present at 12.5% of the sites. These species occurred in low dominance with sago pondweed measuring a 4, Illinois pondweed measuring 3.5, and grassy pondweed measuring 2.5. Sago pondweed and coontail were the most frequently observed species in the 0-5 foot stratum occurring at 33% of the sites. Grassy and Illinois pondweed occurred at 27% of the sites. Illinois pondweed was the most dominant species present in this stratum with a dominance of 8, while sago pondweed and coontail possessed a dominance of 6.7 and grassy pondweed a dominance of 5.3. Large-leaf pondweed and Eurasian watermilfoil were present at 13% of the sites with dominance less than three. Coontail and large-leaf pondweed increased in both frequency and dominance from the 0-5 foot stratum to the 5-10 foot stratum. Coontail, which dominated this stratum, occurred at 43% of the sites with a dominance of 5.6. Sago pondweed and large-leaf pondweed were the next most dense and dominant occurring at 21% and 14% of the sites, respectively with a dominance of 4.3 and 2.9, respectively. Illinois pondweed, grassy pondweed, and Eurasian watermilfoil declined in both density and dominance from the 0-5 foot stratum to the 5-10 foot stratum with all of these species occurring at 7.1% of the sites with a dominance of 1.4. No aquatic plants were present in the 10-15 foot stratum (Appendix B).

Witmer, Westler, and Messick lakes possessed greater numbers of species and greater numbers of native species than the lakes surveyed by Pearson (2004; Table 14). Westler Lake possessed less total species and less native species than the average determined by Pearson (2004), while Hackenburg Lake possessed diversities equal to Pearson's observations. In addition, all Five Lakes had poorer rake diversity than the lakes surveyed by Pearson (2004). Witmer and Westler Lake possessed greater native rake diversity, while Dallas and Messick lakes contained greater site species diversity than the lakes surveyed by Pearson (2004). Overall, all Five Lakes contained higher site species native diversity than the lakes surveyed by Pearson (2004).

Table 14. A comparison of the aquatic plant communities in the Five Lakes to the average values for plant community metrics found by Pearson (2004) in his survey of 21 northern Indiana lakes. Bolding indicates that the value exceeds Pearson average.

Metric	Witmer Lake	Westler Lake	Dallas Lake	Hackenburg Lake	Messick Lake	Indiana Average
Number of species collected	**9**	6	**10**	8	**9**	8
Number of native species	**8**	5	**9**	7	**8**	7
Rake Diversity (SDI)	0.24	0.25	0.17	0.14	0.35	0.62
Native Rake Diversity (SDI)	**0.62**	**0.78**	0.37	0.14	0.21	0.5
Species Richness (avg)	0.72	0.63	0.96	1.07	1.09	1.61
Native Species Richness	0.22	0.16	0.77	1.03	1.00	1.33
Site Species Diversity	0.50	0.42	**0.86**	0.60	**0.84**	0.66
Site Species native diversity	**0.82**	**0.78**	**0.85**	**0.57**	**0.81**	0.56

Aquatic Vegetation Sampling Discussion

The primary focus of an aquatic vegetation management plan update is to document changes within the aquatic plant community due to treatment and seasonal variation and to develop plans for future work. Historic assessments completed in the Five Lakes Chain generally indicated low species diversity coupled with high plant densities.

Overall, the three upper lakes in the chain (Table 15) have historically been dominated by the exotic species, Eurasian watermilfoil. Eurasian watermilfoil dominated the plant communities in Witmer, Westler, and Dallas lakes during the 2005 DNR assessment (DNR data files, 2005). The same conditions were present during the 2006 and 2007 assessments completed by JFNew. In total, Eurasian watermilfoil accounted for 17-30%, 24-30%, and 20-40% of the plant communities within Witmer, Westler, and Dallas lakes, respectively during the 2005 May and August Tier II assessments. The dominance of Eurasian watermilfoil was maintained within these three lakes during the 2006 assessment; however, this species accounted for only 13% of Witmer Lake's plant community, 12% of Westler Lake's plant community, and 6% of Dallas Lake's plant community. In 2007, Eurasian watermilfoil dominance increased within Witmer Lake, remained steady in Westler Lake, and decreased in Dallas Lake. During the August 2007 assessment, Eurasian watermilfoil accounted for 19.3% of Witmer Lake's plant community, 13% of Westler Lake's plant community, and 4.3% of Dallas Lake's plant community.

As previously indicated, low species diversity has historically been indicated within the Five Lakes. In total, four submerged species were identified with Witmer and Westler lakes in 2005, while the DNR identified seven and eight species, respectively, in Dallas Lake during the May and August sampling events. Only three to four species were identified in Hackenburg Lake historically, while

Messick Lake's community is more variable with three to nine submerged species observed by the DNR in 2005. During the 2006 assessment, a minimum of seven species were identified in each of the lakes with Dallas Lake containing the highest diversity with 14 submergent species present during the Tier II survey. In 2007, Witmer Lake contained the lowest species diversity with six species identified, while Dallas and Hackenburg lakes contained the highest diversity with ten submerged species identified. Although species diversity declined from the high variability observed in 2006, diversity remains higher than that previously recorded within the lakes.

Unlike the upper lakes in the chain, Hackenburg and Messick lakes have historically been dominated by coontail. Coontail dominated the plant communities present in Hackenburg and Messick lakes during the 2005 DNR assessments. This plant accounted for 46-67% of Hackenburg Lake's plant community and 20-25% of Messick Lake's plant community during the 2005 assessments. Coontail was again the most dominant species during the 2006 Tier II assessment; however, it was present within 16-17% of the community within these two lakes during the 2006 assessment. In 2007, coontail's dominance rebounded within Hackenburg Lake accounting for 23% of the plant community. Conversely, coontail continued to decline in dominance accounting for only 5% of the submerged aquatic plant community.

8.3 Macrophyte Inventory Discussion

Considering the number of spatial variables that impact the plant community such as boat-traffic and changes in nutrient availability or temporal variables such as climactic conditions, we cannot easily summarize the cause and effect for changes in the plant communities within the Five Lakes. Still, general trends emerge from the data that are useful for the purpose of management decisions. Table 15 details changes in the site frequency, relative and mean density and dominance of Eurasian watermilfoil and curly-leaf pondweed in 2007 within the Five Lakes. When comparing Eurasian watermilfoil site frequency and dominance for the 2005, 2006, and 2007 surveys, it appears that Eurasian watermilfoil site frequency and dominance declined in Witmer and Westler lakes from 2005 to 2006 then increased in 2007. During the 2007 assessment, Eurasian watermilfoil frequencies and dominances remain below those observed in 2005 in both lakes. In Dallas Lake, Eurasian watermilfoil frequencies and dominance continue to decline from the high observed in 2005 to levels observed during 2007. In Hackenburg and Messick Lakes, Eurasian watermilfoil frequencies and dominances increased from 2005 to 2006, but declined to the lowest observed levels in 2007. No pattern can be observed with relation to the frequency, mean and relative density, and dominance of curly-leaf pondweed as observations of this species have occurred sporadically in the Five Lakes (Table 16).

Table 15. Variation in site frequency, relative and mean density, and dominance of Eurasian watermilfoil within the Five Lakes during all assessments.

Lake	Date	Site Frequency	Relative Density	Mean Density	Dominance index
Witmer	5/23/2005	77.0	1.48	1.91	29.5
	8/5/2005	60.8	0.84	1.39	16.9
	8/11/2006	36.7	0.60	1.64	12.0
	8/13/2007	50.0	0.97	1.93	19.3
Westler	5/23/2005	76.0	1.56	2.05	31.2
	8/5/2005	62.5	1.23	1.96	24.5
	8/11/2006	30.0	0.30	1.00	6.0
	8/13/2007	45.0	0.65	1.44	13.0
Dallas	5/23/2005	63.2	0.92	1.45	18.4
	8/5/2005	78.0	2.00	2.56	40.0
	8/11/2006	35.0	0.65	1.86	13.0
	8/13/2007	18.3	0.22	1.18	4.3
Hackenburg	5/23/2005	25.0	0.33	1.33	13.3
	8/5/2005	7.7	0.12	1.50	2.3
	8/11/2006	16.7	0.17	1.00	3.3
	8/13/2007	3.2	0.03	1.00	0.6
Messick	5/23/2005	8.1	0.08	1.00	1.6
	8/5/2005	17.9	0.18	1.00	3.6
	8/11/2006	27.5	0.33	1.18	6.5
	8/13/2007	7.5	0.08	1.00	1.5

Table 16. Variation in site frequency, relative and mean density, and dominance of curly-leaf pondweed within the Five Lakes during all assessments.

Lake	Date	Site Frequency	Relative Density	Mean Density	Dominance index
Witmer	5/23/2005	4.9	0.05	1.00	1.0
	8/5/2005	--	--	--	--
	8/11/2006	--	--	--	--
	8/13/2007	--	--	--	--
Westler	5/23/2005	2.0	0.02	1.00	0.4
	8/5/2005	--	--	--	--
	8/11/2006	--	--	--	--
	8/13/2007	--	--	--	--
Dallas	5/23/2005	4.6	0.05	1.00	0.9
	8/5/2005	1.1	0.01	1.00	0.2
	8/11/2006	--	--	--	--
	8/13/2007	--	--	--	--
Hackenburg	5/23/2005	20.8	0.21	1.00	8.3
	8/5/2005	--	--	--	--
	8/11/2006	3.3	0.03	1.00	0.7
	8/13/2007	--	--	--	--
Messick	5/23/2005	--	--	--	--
	8/5/2005	--	--	--	--
	8/11/2006	--	--	--	--
	8/13/2007	--	--	--	--

These data serve as a baseline by which future variations in the plant community can be compared. Additionally, these data should allow for some determination of future changes in the plant community due to herbicide treatment or other factors (i.e. climate). With this limited data set, we can comment only on variations in the plant community over time and provide only a limited assessment of the reason for change in plant communities in the Five Lakes.

9.0 Aquatic Vegetation Management Alternatives

No new aquatic vegetation management alternatives are available for discussion that have not been covered by previous plans. Consult the original aquatic plant management plan completed by Weed Patrol in 2004 for more information on management alternatives.

10.0 Public Involvement

The LARE biologist, district fisheries biologists, and the contracted herbicide applicator met November 9, 2007 to discuss the 2007 aquatic plant treatment and identify aquatic plant treatment options for 2008. From this meeting, it was determined that aquatic plant growth within the Five Lakes is limited by a number of factors including: amount of available and colonizable substrate, water clarity, water quality, and residence times. In total, nearly 47 acres of dense Eurasian watermilfoil growth were identified during the initial spring survey of the lakes. However, aquatic plant density declined when water clarity declined resulting in sparse plant growth. All meeting attendees agreed that Eurasian watermilfoil growth in the Five Lakes is relatively stable and that treatment of all areas in which Eurasian watermilfoil grows is not the best use of LARE monies or lake association energies at this time. Rather, maintenance treatment for areas of high activity and usage are prioritized for treatment in order to reduce spreading and movement of Eurasian watermilfoil around the lakes. Based on this discussion, an application for the treatment of a total of 19 acres of Eurasian watermilfoil will be filed with the LARE program for next year. The suggested treatment areas are detailed in the Management Action Strategy Section below.

The public meeting for the aquatic plant management plan occurred in concert with a presentation about progress on the watershed projects within the Five Lakes drainage. The meeting occurred on October 13, 2007. During this larger meeting, the LARE program in general and the aquatic plant management program specifically were discussed. Attendees were polled for their thoughts on previous aquatic plant management treatments within the Five Lakes, their thoughts on the lakes' water quality and plant communities, and their use of the lakes. Additionally, results of the initial aquatic plant survey and treatment results were presented and the outline of future activities associated with aquatic plant treatment within the Five Lakes was laid out. Ten people attended the public meeting with at least one individual representing each of the lakes within the chain. Only lake user groups were represented at the meeting. Due to the limited number of attendees, the standard LARE user survey was not completed during this meeting. Rather, individuals were polled for their overall feelings on aquatic plant control efforts within the Five Lakes. Attendees indicated their preference for continued aquatic plant control within the chain in those areas of highest density and usage. Furthermore, attendees expressed the desire for individuals to continue control efforts within channels and along small shoreline areas while the FLCA focused their efforts on public use areas and watershed-based projects.

11.0 Public Education

Future public education efforts associated with the Five Lakes Aquatic Plant Management Plan follow efforts identified during completion of the Five Lakes Watershed Management Plan. These items are not repeated herein. Rather individuals should refer to the FLWMP for more information (JFNew and DJCase, 2006). There is however, an additional species of concern that was identified in Lake Manitou (Fulton County) in 2006. This species is hydrilla (*Hydrilla verticillata*), which is an extremely aggressive submerged aquatic plant species that looks similar to common elodea. The basic difference is the number of leaves: hydrilla contains five leaves while common elodea only contains three leaves. The LARE program continues to fund efforts to control this species in hopes of eradicating it from Lake Manitou within the next five years. Appendix C contains more detailed information on hydrilla, its habitat, and its distribution. Efforts to educate individuals on the control, spread, and other issues associated with this and other exotic species should follow the Stop the Hitchhikers! Campaign which can be found at www.protectyourwaters.net. At a minimum, the FLCA should post warnings and send information to all members of the FLCA about this plant.

12.0 Integrated Management Action Strategy

Specific objectives were not identified during the initial aquatic plant management plan. Therefore, objectives for each goal were developed during completion of this update. The focus of the action strategy should be to meet the three goals identified earlier. These goals are as follows:

1. Develop or maintain a stable, diverse aquatic plant community that supports a good balance of predator and prey fish and wildlife species, good water quality, and is resistant to minor habitat disturbances and invasive species.
2. Direct efforts to preventing and/or controlling the negative impacts of aquatic invasive species.
3. Provide reasonable public recreational access while minimizing the negative impacts on plant, fish, and wildlife resources.

Each goal, along with objectives to meet this goal, is listed below. Following each objective are the actions which should be taken in order to achieve the objective.

12.1 Goal 1: Maintain a stable and diverse aquatic plant community.

The focus of the first goal is on the development and maintenance of a stable, diverse aquatic plant community. To meet this goal, the FLCA should focus both on the emergent plant community and on the submerged plant community as both of these combine to create the aquatic plant community currently present within the Five Lakes.

Objective 1: Maintain the diversity of the rooted floating and emergent portions of the aquatic plant community.
Rooted plant diversity and the areas of rooted and floating species should be protected and enhanced within the Five Lakes, if possible. The emergent and rooted floating plant community identified within the Five Lakes is relatively sparse. The exception to this occurs along areas of undeveloped shoreline within Witmer, Hackenburg, and Dallas lakes. These areas should be protected and treatment of aquatic plant limited along these shorelines. The lakes supports quality rooted plant diversity and this undoubtedly plays a role in supporting its healthy fishery. The density and diversity of the shallow water, emergent plant community prevents shoreline erosion and sediment resuspension; limits the ability for nuisance waterfowl to enter and exit the water onto the shoreline; provides habitat and cover for fish, amphibians, birds, and other wildlife; and filters nutrients that enter the lake from the lakeshore.

Five Lakes' residents should also take steps to restore the lakes' shoreline vegetation. Purple loosestrife and reed canary grass were identified in several locations along the lakeshore and in adjacent lawns. Both of these species are introduced from Eurasia and spread rapidly through prolific seed production, vegetative growth, and cultivation. Without individual control, both species can spread along the lakeshore inhibiting boat mooring and individual access to the lake. The LARE program does not provide funding for the control of either of these species at this time. Nonetheless, residents should become familiar with these plants and methods for their control. The two easiest ways to control the spread of both species is through hand pulling or digging and the application of herbicides. Removal of these species and restoration of the shoreline would return many of the functions provided by healthy riparian areas. Landowners should replace these plants with native species that provide equal or better quality aesthetics and are more useful to birds, butterflies, and other wildlife as habitat and a food source. Reed canary grass should be replaced with switch grass, Indian grass, or even big blue stem depending on the landowner's desired landscaping. Swamp blazing star, swamp milkweed, cardinal flower, blue-flag iris, or blue lobelia all offer more habitat and aesthetic variety than that offered by purple loosestrife. A mixture of these species will also allow for colorful blooms throughout the growing season.

Objective 2: Maintain the density and diversity of the submerged portion of the aquatic plant community.
The Five Lakes' aquatic plant community is relatively diverse. However, the lakes' submerged communities contained between seven and eleven species during the aquatic plant surveys. This diversity is relativity low for area lakes and could be improved with improved water quality and control of exotic species. The variety of submerged plant species present in the Five Lakes provides fish cover and habitat for macroinvertebrates, amphibians, and reptiles; filters nutrients; and increases the aesthetic conditions present in these lakes. However, water clarity limits the growth of submerged aquatic plants during the height of the summer. Nonetheless, lake residents and users should become aware of the quality of their aquatic plant community and should limit the control or removal of the native populations of submerged aquatic plants. Native species should be controlled only in those locations where the density of aquatic plants limits the aesthetic value or negatively impacts lake use. Control of native communities should be limited in shallow areas or around docks; treatment should only occur if there are difficulties in maneuvering boats to and from docks or other shoreline structures. Other specifics of native plant control are detailed below.

Objective 3: Improve water quality within the lakes and their watershed.
The aquatic plant community within the Five Lakes is limited by the lakes' retention time, or how quickly water is maintained within the lakes, and the lakes' water clarity. As detailed in Table 1, water clarity within the Five Lakes is typically moderate to good in the spring. However, as water temperatures and day length increase, water clarity within the lakes typically declines. This results in conditions which limit the growth of aquatic plants within the lakes. To counteract this process, nutrient and sediment loading from the watershed needs to be limited. The FLCA is addressing these concerns through the implementation of their watershed management plan with projects currently in the design stage. Once these projects are implemented, additional watershed assessments should occur to identify additional feasible water quality implementation projects. Due to the watershed's size, it is likely that the implementation of multiple projects is necessary to result in an improvement in water quality within the Five Lakes. The FLCA should continue working to improve water quality through the implementation of watershed-based projects focused on the reduction in sediment and nutrient loading.

12.2 Goal 2: Reduce negative impacts from exotic and/or invasive species.
The focus of the second goal is on reducing the negative impacts from aquatic exotic or invasive species. This goal can be accomplished by reducing the density and coverage of current populations of exotic and/or invasive species and preventing the introduction of new species and the spread of current species to areas of the lake where exotic, invasive species are currently not present. Goal 2 builds on the objectives detailed in Goal 1 in that efforts to reach Goal 2 will assist the FLCA in reaching Goal 1.

Objective 1: Reduce the density and abundance of Eurasian watermilfoil.
During the spring, Eurasian watermilfoil is present in relatively high density in relatively contained locations within the Five Lakes. However, water clarity limits the prevalence of this species during

peak usage of the Five Lakes. Nonetheless, in order to prevent the continued spread of Eurasian watermilfoil to other locations within the lake, a control program should be enacted. Eurasian watermilfoil reproduces through fragmentation and can rapidly spread to other areas of the lake and can reach nuisance levels. This species can displace native vegetation and has a tendency to form dense canopies that shade out native vegetation. In order to control Eurasian watermilfoil within the Five Lakes, the use of 2,4-D (Navigate) or Renovate for spot treatment of populations is recommended. Only those areas where Eurasian watermilfoil are present and which are subject to high traffic should be considered for treatment of Eurasian watermilfoil. As identified during this assessment, up to 19 acres of Eurasian watermilfoil are recommended for treatment (Figure 5). The cost of this treatment is approximately $7,125 if 2,4-D is used for treatment within the Five Lakes. Additional annual follow-up treatments will likely be necessary to control Eurasian watermilfoil populations within the Five Lakes.

In order to aid in the control of Eurasian watermilfoil, lake residents and users should be educated as to their impact on the spread of the plant. Eurasian watermilfoil spreads through fragmentation, which allows one small piece of Eurasian watermilfoil to colonize other areas of the lake. It is very important that boaters avoid driving through areas of the lake currently infested with Eurasian watermilfoil as this can chop the plant thereby creating fragments. These fragments can then be carried to other areas on boat propellers or float to other areas of the lake. It is also important the boaters remove all plant fragments from their boat propeller and trailer before traveling from lake to lake. If signs are currently not posted at the boat ramp detailing the need to clean boats and trailers, then signs should be posted warning boat owners and users to check their equipment for plant fragments.

Finally, as the overall plant community is relatively sparse during the summer when Tier II surveys occur, the Five Lakes Conservation Association is not setting a specific percent coverage or density goal for Eurasian watermilfoil. Rather, the FLCA prefers to target treatment at only those high usage areas where fragmentation of Eurasian watermilfoil by individuals boating through plant beds will result in the continued spread of this exotic species. This is highlighted in Witmer Lake where the frequency of Eurasian watermilfoil totaled 50%; however, treatment will be limited to only those areas of high use rather than treating undeveloped shorelines at the east and west ends of the lake where Eurasian watermilfoil is especially prevalent.

Objective 2: Prevent the spread of purple loosestrife, giant reed, and reed canary grass.
Purple loosestrife, giant reed, and reed canary grass can be detrimental to native shoreline and wetland species. Currently, control of these species is not funded through the LARE program. Nonetheless, if either of these species are present on an individual property, then the species should be removed through hand pulling and removal of the root structure. Removal should occur prior to the plants flowering.

Objective 3: Educate lake users and shoreline owners about the impacts of exotic and invasive species.
Currently, Indiana is home to three exotic, invasive submerged aquatic plant species: Eurasian watermilfoil, curly-leaf pondweed, and hydrilla. To date, hydrilla is limited to one lake—Lake Manitou in Rochester, Indiana. In order to prevent the spread of this and other exotic species, lake users should be educated regarding the potential impacts of these species and the threat of their spread. All three species spread by fragmentation allowing them to spread from one area to another within a lake and from lake to lake. Therefore, it is imperative that users remove all plant fragments from boats and trailers when entering and exiting lakes. Posting signs at the boat ramp will help

reinforce this effort. The FLCA should include information about hydrilla, Eurasian watermilfoil, and curly-leaf pondweed in their newsletters and on their website. Educational information about these and other exotic species can be found at the Stop Aquatic Hitchhikers! website (www.protectyourlake.net.).

12.3 Goal 3: Provide reasonable recreational access while minimizing the negative impacts on plants, fish, and wildlife resources.

This goal focuses on the control of exotic species for recreational purposes; however, the control of a limited number of native species may also be necessary to meet reasonable recreational access goals. The Five Lakes are primarily a recreation lakes where swimming, fishing, and pleasure boating are balanced with skiing, high speed boating, and the use of personal watercraft. In order to maintain aesthetic and ecological quality in the Five Lakes, it may be necessary to balance recreational uses.

Objective 1: Allow boat access through the control of aquatic vegetation around boat docks.

Native species proliferate in many areas of the Five Lakes but are typically limited to dense growth within private channels. However, in some areas of the chain, native aquatic plants proliferate. If allowed to continue to grow, these plants may begin to restrict shoreline owner access to the lake from their dock. In these areas, hand removal or spot chemical treatment of plants should be implemented. Up to 625 square feet of vegetation can be removed from an individual shoreline without a permit. Removal of aquatic vegetation should be limited in the Five Lakes to only those areas where boat access is necessary. This typically measures 20 to 30 feet. Additionally, aquatic plants should not be treated farther than 100 feet from the lakeshore. No extraneous removal of aquatic vegetation is recommended at this time. If plants are removed from the lake by hand, they should not be left along the shoreline to desiccate. Rather, plants should be removed from the lakeshore and deposited in compost piles, gardens, or bagged for removal. If hand-pulling is not an option, residents should contact a certified aquatic applicator to implement treatment.

12.4 Immediate Action Plan

The LARE Aquatic Plant Management Plan grant was provided to the Five Lakes Conservation Association for the purpose of funding aquatic vegetation controls on the lake. These controls should be approached using a three-prong effort: control of exotic species and nuisance native species; restoration or preservation of native plant communities; and education of lake users. Below, recommended actions are listed in order of importance. It should be noted that some of these actions may be funded through the LARE program; however, alternate sources of public or private monies may need to be obtained by the FLCA in order to implement these actions.

1. Continue spot treatment of up to 19 acres of Eurasian watermilfoil throughout the lake chain. Areas to be treated are located in high usage areas where fragmentation of Eurasian watermilfoil due to boating, which possesses a narrow shelf upon which dense aquatic plant growth occurs.
2. Monitor the plant community using aquatic plant surveys for next five years (2008-2012). These surveys should occur both prior to treatment and following treatment to assess the effectiveness of controls and response of native plant community to these treatments. In 2008, surveys should consist of a reconnaissance survey prior to treatment of Eurasian watermilfoil. A second, post-treatment reconnaissance survey and Tier II survey should occur following treatment. Efforts should be made to align post-treatment survey dates with similar dates of surveys in the past. These surveys should be continued through 2012.
3. Post signs at all access sites in warning boaters of the potential for invasive plant species introductions from boat trailers. Signs should implore boaters to clean trailers, propellers.

and boats of all vegetative fragments when entering and leaving the Five Lakes. This is especially important given the high density of off-shore users and the high number of tournaments that occur on the lake. Information concerning the potential spread of Eurasian watermilfoil and hydrilla should be distributed to all FLCA members and lake users.

4. Investigate potential options to reduce nutrient and sediment loading to the lake through watershed management planning or implementation projects.
5. Remove purple loosestrife and reed canary grass from individual properties.
6. Maintain dock areas with physical plant removal when possible or by contracting professional applicators. Treatments should not exceed 100 feet from shoreline for submersed vegetation and treatment of rooted floating vegetation should be limited to boating lanes.
7. Educate lake users on best management practices in order to improve water quality.

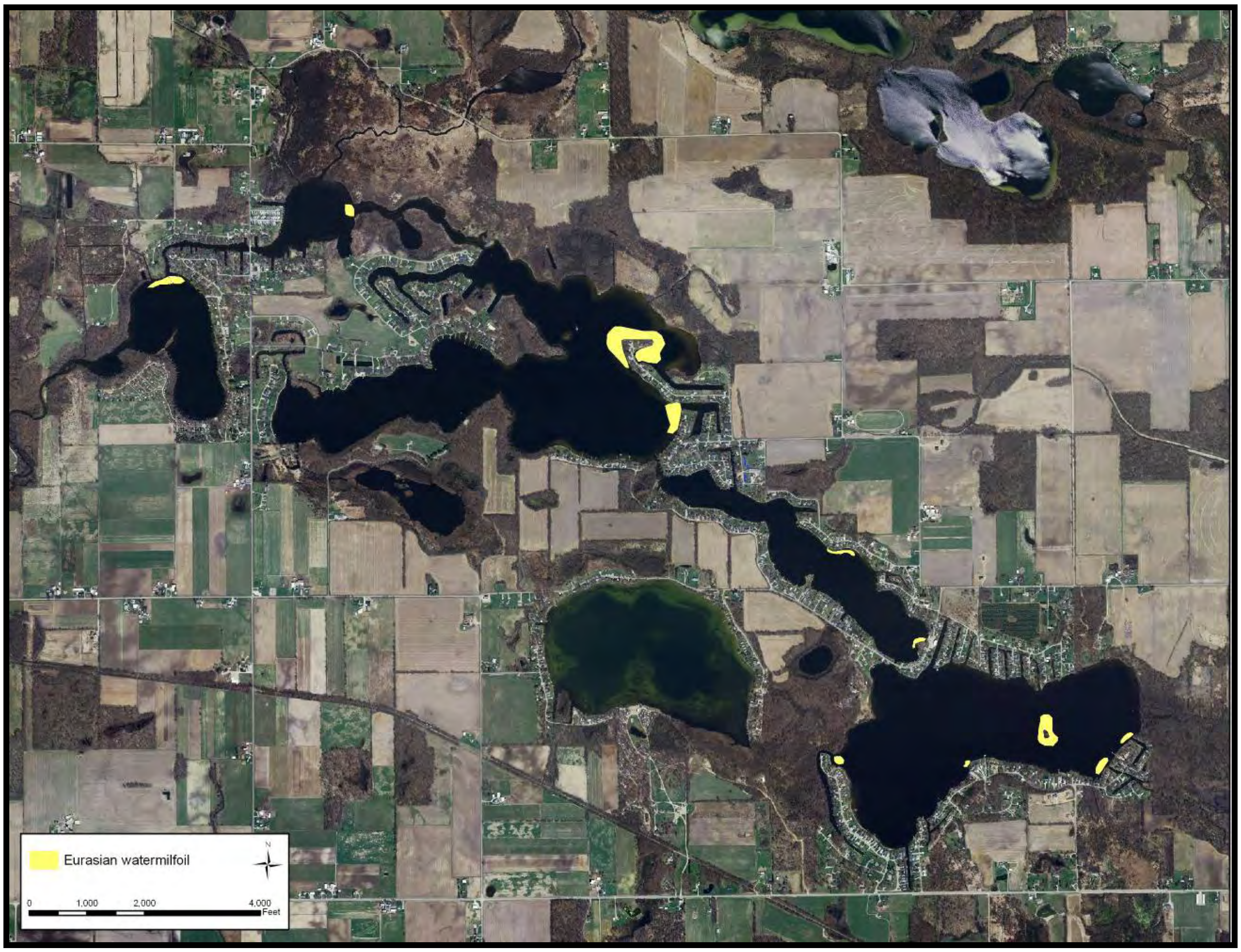

Figure 5. Recommended 2008 treatment areas within the Five Lakes.

13.0 Project Budget

Table 17 contains an **estimated** budget for the aquatic vegetation management action plan for the Five Lakes. The majority of the annual cost is associated with aquatic plant surveys. As such, the DNR may deem annual surveys unnecessary and allow for one survey to occur every two years to track changes in the aquatic plant community. Additionally, as it is unlikely that the recommended treatment program will result in reductions in Eurasian watermilfoil density, costs associated with annual treatment remain largely the same for the next five years. Finally, because the main treatment recommended in the Five Lakes consists of treatment of Eurasian watermilfoil in high traffic areas, the long term goal of the program is one of limited impact rather than control or eradication. It is our recommendation that the Five Lakes Conservation Association requests $20,125 from the LARE program. This budget includes the $7,125 in-lake treatment and $13,000 for aquatic plant surveys and plan updates. A permit for this treatment is included in Appendix D. This permit should be submitted by the association and, once a contractor is selected for the treatment, the permit can be completed. It is possible that this project may not be fully-funded due to a recent hydrilla infestation in Lake Manitou that may use a large percentage of potential LARE funds.

Table 17. Budget estimate for the action plan, 2008-2012.

Task	2008	2009	2010	2011	2012
Eurasian watermilfoil treatment	$7,125	$8,000	$8,000	$9,000	$9,000
Plant sampling and plan update	$13,000	$13,000	$13,000	$14,000	$14,000
Total	**$20,125**	**$21,000**	**$21,000**	**$23,000**	**$23,000**

Costs for aquatic plant assessment and treatment in 2008 are as follows:

- Eurasian watermilfoil treatment of approximately 19 acres at a cost of $375 per acre for a maximum total cost of $7,125.
- Standard LARE assessment, public meeting, and plan update costs are based on 2007 LARE requirements (one pre-treatment survey; one Tier II survey; one public meeting; DNR/LARE meeting; plan update). Assessment costs and plan updates costs are estimated to total $13,000.

Total fees for 2007 aquatic plant assessment, herbicide application, and plan updated are estimated at $20,125.

The following time schedule is anticipated for aquatic plant management activities for the Five Lakes in 2008:

May 15-June 15, 2008	Pre-treatment assessment
May 15-June 15, 2008	LARE-funded aquatic plant treatment
July 15-August 30, 2008	Tier II post-treatment assessment
August-September, 2008	Public meeting
November 2008	Meeting between IDNR LARE and fisheries staff, FLCA, and contractor
December 15, 2008	Plan update and permit and LARE application for 2009 funding due

14.0 Monitoring and Plan Update Procedures

Monitoring shall follow procedures determined by the LARE program. Likewise, plan updates will conform to LARE requirements. Additional monitoring and treatment may occur outside of the LARE program. This could include, but is not limited to: assessment and treatment of channel areas to limit Eurasian watermilfoil re-growth and privately-funded aquatic plant assessments. As these items are not part of the LARE program, their inclusion in any future LARE aquatic plant management plan updates is not required; however, their inclusion is suggested as a mechanism to contain all pertinent aquatic plant management information in one location and deal with changes in community and treatment requirements at one time even if all actions are not funded through the LARE program.

15.0 References Cited

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Indiana Department of Natural Resources. 2006b. Tier II aquatic vegetation survey protocol. Indianapolis, Indiana.

JFNew and DJCase. 2006. Five Lakes Watershed Management Plan, Lagrange and Noble Counties, Indiana. Walkerton, IN.

Pearson, J. 2004. A sampling method to assess occurrence, abundance and distribution of submersed aquatic plants in Indiana lakes. Indiana Department of Natural Resources, Division of Fish and Wildlife, Indianapolis, Indiana.

Weed Patrol, Inc. 2005 Version 2. Indian Lakes Chain Aquatic Plant Management Plan 2005-2008. Indiana Department of Natural Resources, Division of Fish and Wildlife, Indianapolis, Indiana.

APPENDIX A:

TIER II SURVEY RAW DATA

FIVE LAKES
AQUATIC PLANT MANAGEMENT PLAN UPDATE 2007

Five Lakes summer Tier II survey raw data as collected August 13, 2007.

LAKE	DEPTH	FILALG	CERDEM	CHARA	MYREXA	MYRSPI	NAJGUA	NAJMAR	POTAMP	POTBER	POTFOL	POTGRA	POTILL	POTNAT	POTPEC	POTZOS	UTRVUL	X_COOR	Y_COOR
Dallas	3											1	1		1			632582.2844	4601230.491
Dallas	3																	632425.7419	4601351.095
Dallas	3	p																632321.0408	4601464.283
Dallas	3							1				1						631876.9446	4601500.601
Dallas	3					1						1				1		632155.5319	4600659.6
Dallas	4																	631674.56	4601667.725
Dallas	4							1	1									631505.1345	4601581.564
Dallas	4	p										1	1					632485.5517	4600817.505
Dallas	5																	632195.7463	4601183.947
Dallas	5	p		1				1				1	1					632437.3929	4601138.368
Dallas	5					1		1				1						632037.941	4601556.649
Dallas	5																	631522.674	4601740.558
Dallas	5	p																631562.9927	4601526.479
Dallas	5					1						1	1		1			631884.5331	4601163.671
Dallas	5					1			1				1					631380.168	4601252.101
Dallas	5	p		1		1												631234.4863	4601100.88
Dallas	5																	630582.9294	4600935.354
Dallas	5		1															630441.8161	4600731.175
Dallas	5																	630733.8488	4600685.782
Dallas	5																	631344.1717	4600815.622
Dallas	5																	631664.1406	4600728.51
Dallas	6	p																632492.8892	4601301.025
Dallas	6		1															631424.7333	4601601.137
Dallas	6		1			1		1				1						631853.7276	4601260.988
Dallas	6		1			3												631652.8207	4601123.228
Dallas	7	p				1												632195.6793	4601297.19
Dallas	7	p																632364.3811	4601308.14
Dallas	7		1									1	1					631564.2322	4601759.577
Dallas	7	p	1					1					1					631705.2876	4601462.352
Dallas	8	p		1		1									1			632406.0489	4601245.087
Dallas	8					1		1										631710.9021	4601633.32
Dallas	8																	631049.8603	4601081.524
Dallas	8	p																630413.1102	4600811.074
Dallas	9																	632038.7224	4601520.35
Dallas	9																	631669.0145	4600794.868
Dallas	10			1		1												632347.37	4601223.912
Dallas	10																	631937.5635	4601542.637
Dallas	10	p																631837.6784	4601538.194
Dallas	10																	631579.2312	4601735.312
Dallas	10																	631549.6818	4601132.711
Dallas	11																	632274.699	4601075.428
Dallas	11																	632368.7104	4601358.166
Dallas	11	p																632324.1927	4601392.97
Dallas	11																	632030.4895	4601453.319
Dallas	12			1														632401.7122	4601159.587
Dallas	12							1				1	1		1		1	632544.2796	4601195.679
Dallas	12			1														632346.8655	4601398.61
Dallas	12																	630483.9069	4600984.099
Dallas	12																	630431.5774	4600927.787
Dallas	14																	632341.1903	4601372.735
Dallas	15																	632392.1739	4600714.003

LAKE	DEPTH	FILALG	CERDEM	CHARA	MYREXA	MYRSPI	NAJGUA	NAJMAR	POTAMP	POTBER	POTFOL	POTGRA	POTILL	POTNAT	POTPEC	POTZOS	UTRVUL	X_COOR	Y_COOR
Dallas	16																	632288.6481	4601309.071
Dallas	16																	630563.6167	4600751.946
Dallas	17																	632487.8879	4601213.999
Dallas	17																	632289.6227	4601418.368
Dallas	18																	631823.4012	4601307.78
Dallas	18																	630950.3231	4601021.278
Dallas	20																	632248.3121	4601434.625
Dallas																		632183.8759	4601551.178
Hackenburg	3	p	5															630595.0778	4602089.52
Hackenburg	4	p	1															630742.3554	4601982.634
Hackenburg	4	p																630360.8785	4601725.148
Hackenburg	4	p										1	1					630487.2714	4601750.598
Hackenburg	5	p	3															630647.4334	4602069.355
Hackenburg	5	p	1															630521.3108	4602057.325
Hackenburg	5	p																630463.6288	4601974.803
Hackenburg	5	p	1															630455.7994	4601939.048
Hackenburg	5	p	1	1														630443.8256	4601877.831
Hackenburg	5	p	3														1	630733.2571	4601808.201
Hackenburg	5	p																630756.3273	4601904.223
Hackenburg	6	p	3														1	630688.0684	4602036.875
Hackenburg	6	p	1							1		1						630495.5665	4602047.981
Hackenburg	6	p	3												1			630421.8314	4601760.931
Hackenburg	6	p	5															630658.5676	4601813.15
Hackenburg	7	p	1															630709.6664	4602010.06
Hackenburg	7	p	1									1						630762.1541	4601786.447
Hackenburg	8	p																630756.9921	4601947.442
Hackenburg	8	p	1															630697.9207	4601969.772
Hackenburg	8	p													1			630484.7815	4602009.219
Hackenburg	8	p	3															630733.6044	4601754.969
Hackenburg	9	p	5	1														630661.1718	4602052.193
Hackenburg	9	p	1			1												630648.5077	4602028.641
Hackenburg	10	p																630731.3862	4601862.925
Hackenburg	11	p																630711.4084	4601922.334
Hackenburg	11	p	1															630531.9584	4601761.322
Hackenburg	12	p	1															630454.5606	4601781.273
Hackenburg	14	p	1															630661.2918	4602003.583
Hackenburg	14	p																630464.9309	4601816.481
Hackenburg	15	p																630555.6312	4602040.212
Hackenburg	15	p	1															630608.7388	4601802.447
Messick	3	p	1															629742.1625	4601184.818
Messick	3										1	1						630071.574	4601191.804
Messick	3	p	1						1				1		1			629863.5998	4601565.869
Messick	4																	630114.7296	4600901.784
Messick	4		1															630108.8504	4600945.286
Messick	4	p													1			630096.5283	4601009.975
Messick	4	p																630043.4417	4601244.55
Messick	4	p					1					1	3					630001.8625	4601468.915
Messick	5	p	1															629716.1483	4601518.972
Messick	5	p				1												629844.7093	4601192.356
Messick	5		1						1			1	1					629941.0352	4601017.476
Messick	5																	630078.199	4600863.987
Messick	5	p				1								1	1			630083.5952	4601065.337

LAKE	DEPTH	FILALG	CERDEM	CHARA	MYREXA	MYRSPI	NAJGUA	NAJMAR	POTAMP	POTBER	POTFOL	POTGRA	POTILL	POTNAT	POTPEC	POTZOS	UTRVUL	X_COOR	Y_COOR
Messick	5	p							1_						1			630042.7024	4601338.215
Messick	5	p						1				1	1		1			629966.1399	4601501.249
Messick	6																	629678.7888	4601487.232
Messick	6	p	1															629671.7221	4601324.29
Messick	6																	629776.8853	4601209.68
Messick	6	p	1				1								1			630029.7845	4601379.435
Messick	7	p	1						1									629790.7366	4601549.387
Messick	7																	629906.4281	4600886.739
Messick	7	p													1			629948.8102	4600853.375
Messick	7	p	1						1			1	1					630048.3542	4601301.502
Messick	8	p				1												629871.7342	4601231.854
Messick	9	p	1															629975.6169	4601447.535
Messick	9	p													1			629904.1938	4601536.888
Messick	10	p	1															629752.7032	4601523.899
Messick	10																	629898.8014	4601017.797
Messick	10																	630007.1711	4600850.494
Messick	11	p																629774.9157	4601493.496
Messick	12	p																629666.9243	4601401.042
Messick	12	p																629660.5521	4601328.136
Messick	12																	629664.4674	4601269.527
Messick	12	p																629881.9213	4601277.948
Messick	12																	629893.8596	4600933.189
Messick	13																	629692.7035	4601220.88
Messick	14	p																629895.6569	4601097.495
Westler	3		1			1												633519.5989	4600120.428
Westler	3	p																633091.0298	4600451.648
Westler	4																	632618.8218	4600412.02
Westler	4	p				3												633025.8248	4600275.735
Westler	4					1												633792.1378	4599675.065
Westler	4	p																633824.0612	4599790.88
Westler	5					3												632451.9724	4600512.689
Westler	5	p				1												632506.3359	4600474.293
Westler	5					1												632562.8565	4600437.73
Westler	5	p	1			1												633091.5961	4600073.115
Westler	5																	633398.3037	4599914.564
Westler	5					1												633696.3434	4599622.609
Westler	5																	633736.5703	4599850.658
Westler	5					1												633565.7264	4600011.138
Westler	5	p																633312.2173	4600182.524
Westler	5																	632955.384	4600407.379
Westler	6	p				3												633003.4981	4600333.112
Westler	6					3												633028.8766	4600149.444
Westler	6					1												633588.432	4599709.252
Westler	7	p				1												632919.5576	4600350.611
Westler	7					1												633768.7987	4599611.151
Westler	7	p																632793.5917	4600471.555
Westler	7																	632623.7425	4600559.675
Westler	8																	632742.9503	4600402.604
Westler	8					1												632829.7199	4600367.987
Westler	8					1												633261.4959	4600027.306
Westler	8																	633678.7498	4599922.366
Westler	8					1												633508.8497	4599788.521

LAKE	DEPTH	FILALG	CERDEM	CHARA	MYREXA	MYRSPI	NAJGUA	NAJMAR	POTAMP	POTBER	POTFOL	POTGRA	POTILL	POTNAT	POTPEC	POTZOS	UTRVUL	X_COOR	Y_COOR
Westler	10																	633028.4924	4600186.048
Westler	10																	633135.8185	4600333.071
Westler	10	p																632654.9407	4600564.942
Westler	11					1												632669.7563	4600406.896
Westler	12																	633196.0427	4600040.155
Westler	12																	633793.2702	4599726.361
Westler	12																	632544.6064	4600545.097
Westler	13																	633063.9137	4600127.239
Westler	15																	633595.8782	4599946.333
Westler	15																	633523.2141	4600086.643
Westler	15																	633431.6081	4600145.629
Westler	15	p				1												633102.9458	4600402.966
Witmer	2	p																633687.9069	4598684.927
Witmer	3					3												633578.1126	4599278.247
Witmer	3					5												633459.6479	4599215.783
Witmer	3																	633468.3524	4599046.252
Witmer	3																	633517.7445	4598750.791
Witmer	3																	633720.1583	4598620.363
Witmer	3						1											634362.3943	4599460.015
Witmer	3																	634312.6062	4599501.922
Witmer	3																	634073.0667	4599553.222
Witmer	4					5												633584.4667	4599448.679
Witmer	4					3												633604.1856	4599306.163
Witmer	4	p				5												633382.1252	4599071.951
Witmer	4					1												633483.3057	4598894.764
Witmer	4					1												634078.4245	4599065.589
Witmer	4																	634280.8301	4599106.881
Witmer	4																	634408.0267	4599080.088
Witmer	4					3												634791.9907	4599057.656
Witmer	4					1						1	1			1		634817.7905	4599120.633
Witmer	4					5												634934.0275	4599397.327
Witmer	4																	634645.9695	4599523.534
Witmer	4				1				1									634491.0957	4599463.707
Witmer	4				1	1												634408.3623	4599468.674
Witmer	4					1												634121.4761	4599536.52
Witmer	4																	633934.2292	4599547.76
Witmer	4																	633692.5324	4599536.74
Witmer	5					1												633579.1819	4599525.144
Witmer	5																	633588.3539	4599370.763
Witmer	5	p	1			1												633515.5081	4599248.993
Witmer	5																	633451.7955	4599014.054
Witmer	5																	633517.991	4598809.824
Witmer	5					1												633896.4115	4598863.477
Witmer	5	p	1															633908.2406	4598892.252
Witmer	5																	633961.5052	4598927.855
Witmer	5																	634053.1081	4599017.521
Witmer	5																	634207.7457	4599123.456
Witmer	5					1												634443.5848	4599070.199
Witmer	5					1												634689.2156	4599033.208
Witmer	5					3												634899.7282	4599220.111
Witmer	5		1	5														634931.7785	4599261.042
Witmer	5					3												634944.343	4599326.026

LAKE	DEPTH	FILALG	CERDEM	CHARA	MYREXA	MYRSPI	NAJGUA	NAJMAR	POTAMP	POTBER	POTFOL	POTGRA	POTILL	POTNAT	POTPEC	POTZOS	UTRVUL	X_COOR	Y_COOR
Witmer	5		1			1												634844.3205	4599561.766
Witmer	5																	633997.2357	4599571.556
Witmer	5					1												633774.6646	4599480.995
Witmer	6				1													634785.5264	4599580.774
Witmer	7					1												633778.467	4598831.935
Witmer	7					1												634019.3202	4598971.641
Witmer	7					1												634859.1642	4599173.368
Witmer	7					1												634879.8464	4599368.647
Witmer	8																	633616.0141	4599568.411
Witmer	8					1												633783.7173	4598682.093
Witmer	8																	634370.3935	4599091.019
Witmer	8																	634907.2006	4599469.869
Witmer	8					1												634225.723	4599488.725
Witmer	8	p				3												633867.3248	4599537.688
Witmer	8					1												634552.7516	4599047.621
Witmer	9																	633503.372	4598859.46
Witmer	9																	634156.6663	4599122.207
Witmer	9					1												634601.5949	4599517.095
Witmer	10																	634527.9617	4599086.942
Witmer	10																	634550.2221	4599482.968

APPENDIX B:

TIER II SURVEY RESULTS

FIVE LAKES
AQUATIC PLANT MANAGEMENT PLAN UPDATE 2007

Witmer Lake summer Tier II survey metrics and data as collected August 13, 2007.

Entire Lake (0-10')			Density Scale				
Scientific Name	**Common Name**	**Frequency of Occurrence**	**0**	**1**	**3**	**5**	**Dominance**
Myriophyllum spicatum	Eurasian watermilfoil	50.00	50.00	33.33	10.00	6.67	19.33
Chara spp.	Chara	1.67	98.33	0.00	0.00	1.67	1.67
Ceratophyllum demersum	Coontail	6.67	93.33	6.67	0.00	0.00	1.33
Myriophyllum exalbescens	Northern watermilfoil	5.00	95.00	5.00	0.00	0.00	1.00
Potamogeton zosteriformes	Flat-stem pondweed	1.67	98.33	1.67	0.00	0.00	0.33
Potamogeton illinoensis	Illinois pondweed	1.67	98.33	1.67	0.00	0.00	0.33
Potamogeton gramineus	Grassy pondweed	1.67	98.33	1.67	0.00	0.00	0.33
Potamogeton amplifolius	Large-leaf pondweed	1.67	98.33	1.67	0.00	0.00	0.33
Najas guadalupensis	Southern naiad	1.67	98.33	1.67	0.00	0.00	0.33
Filamentous algae	Filamentous algae	8.33					

0-5' stratum			Density Scale				
Scientific Name	**Common Name**	**Frequency of Occurrence**	**0**	**1**	**3**	**5**	**Dominance**
Myriophyllum spicatum	Eurasian watermilfoil	50.00	50.00	29.55	11.36	9.09	21.82
Chara spp.	Chara	2.27	97.73	0.00	0.00	2.27	2.27
Ceratophyllum demersum	Coontail	9.09	90.91	9.09	0.00	0.00	1.82
Myriophyllum exalbescens	Northern watermilfoil	4.55	95.45	4.55	0.00	0.00	0.91
Potamogeton zosteriformes	Flat-stem pondweed	2.27	97.73	2.27	0.00	0.00	0.45
Potamogeton illinoensis	Illinois pondweed	2.27	97.73	2.27	0.00	0.00	0.45
Potamogeton gramineus	Grassy pondweed	2.27	97.73	2.27	0.00	0.00	0.45
Potamogeton amplifolius	Large-leaf pondweed	2.27	97.73	2.27	0.00	0.00	0.45
Najas guadalupensis	Southern naiad	2.27	97.73	2.27	0.00	0.00	0.45
Filamentous algae	Filamentous algae	9.09					

5-10' stratum			Density Scale				
Scientific Name	**Common Name**	**Frequency of Occurrence**	**0**	**1**	**3**	**5**	**Dominance**
Myriophyllum spicatum	Eurasian watermilfoil	50.00	50.00	43.75	6.25	0.00	12.50
Myriophyllum exalbescens	Northern watermilfoil	6.25	93.75	6.25	0.00	0.00	1.25
Filamentous algae	Filamentous algae	6.25					

Westler Lake summer Tier II survey metrics and data as collected August 13, 2007.

Entire Lake (0-15')			**Density Scale**				
Scientific Name	**Common Name**	**Frequency of Occurrence**	**0**	**1**	**3**	**5**	**Dominance**
Myriophyllum spicatum	Eurasian watermilfoil	47.50	52.50	37.50	10.00	0.00	13.50
Potamogeton amplifolius	Large-leaf pondweed	5.00	95.00	5.00	0.00	0.00	1.00
Najas guadalupensis	Southern naiad	5.00	95.00	5.00	0.00	0.00	1.00
Stuckenia pectinatus	Sago pondweed	5.00	95.00	5.00	0.00	0.00	1.00
Ceratophyllum demersum	Coontail	5.00	95.00	5.00	0.00	0.00	1.00
Potamogeton gramineus	Grassy pondweed	2.50	97.50	2.50	0.00	0.00	0.50
Filamentous algae	Filamentous algae	27.50					

0-5' stratum			**Density Scale**				
Scientific Name	**Common Name**	**Frequency of Occurrence**	**0**	**1**	**3**	**5**	**Dominance**
Myriophyllum spicatum	Eurasian watermilfoil	56.25	43.75	43.75	12.50	0.00	16.25
Ceratophyllum demersum	Coontail	12.50	87.50	12.50	0.00	0.00	2.50
Potamogeton gramineus	Grassy pondweed	6.25	93.75	6.25	0.00	0.00	1.25
Potamogeton amplifolius	Large-leaf pondweed	6.25	93.75	6.25	0.00	0.00	1.25
Najas guadalupensis	Southern naiad	6.25	93.75	6.25	0.00	0.00	1.25
Stuckenia pectinatus	Sago pondweed	6.25	93.75	6.25	0.00	0.00	1.25
Filamentous algae	Filamentous algae	37.50					

5-10' stratum			**Density Scale**				
Scientific Name	**Common Name**	**Frequency of Occurrence**	**0**	**1**	**3**	**5**	**Dominance**
Myriophyllum spicatum	Eurasian watermilfoil	53.33	46.67	40.00	13.33	0.00	16.00
Potamogeton amplifolius	Large-leaf pondweed	6.67	93.33	6.67	0.00	0.00	1.33
Najas guadalupensis	Southern naiad	6.67	93.33	6.67	0.00	0.00	1.33
Stuckenia pectinatus	Sago pondweed	6.67	93.33	6.67	0.00	0.00	1.33
Filamentous algae	Filamentous algae	26.67					

10-15' stratum			**Density Scale**				
Scientific Name	**Common Name**	**Frequency of Occurrence**	**0**	**1**	**3**	**5**	**Dominance**
Myriophyllum spicatum	Eurasian watermilfoil	22.22	77.78	22.22	0.00	0.00	4.44
Filamentous algae	Filamentous algae	11.11					

Dallas Lake summer Tier II survey metrics and data as collected August 13, 2007.

Entire Lake (0-15')			Density Scale				
Scientific Name	**Common Name**	**Frequency of Occurrence**	**0**	**1**	**3**	**5**	**Dominance**
Myriophyllum spicatum	Eurasian watermilfoil	18.33	81.67	16.67	1.67	0.00	4.33
Potamogeton gramineus	Grassy pondweed	16.67	83.33	16.67	0.00	0.00	3.33
Potamogeton illinoensis	Illinois pondweed	13.33	86.67	13.33	0.00	0.00	2.67
Najas marina	Spiny naiad	13.33	86.67	13.33	0.00	0.00	2.67
Chara spp.	Chara	10.00	90.00	10.00	0.00	0.00	2.00
Ceratophyllum demersum	Coontail	10.00	90.00	10.00	0.00	0.00	2.00
Stuckenia pectinatus	Sago pondweed	6.67	93.33	6.67	0.00	0.00	1.33
Potamogeton amplifolius	Large-leaf pondweed	3.33	96.67	3.33	0.00	0.00	0.67
Utricularia vulgaris	Common bladderwort	1.67	98.33	1.67	0.00	0.00	0.33
Potamogeton zosteriformes	Flat-stem pondweed	1.67	98.33	1.67	0.00	0.00	0.33
Filamentous algae	Filamentous algae	21.67					

0-5' stratum			Density Scale				
Scientific Name	**Common Name**	**Frequency of Occurrence**	**0**	**1**	**3**	**5**	**Dominance**
Potamogeton gramineus	Grassy pondweed	33.33	66.67	33.33	0.00	0.00	6.67
Potamogeton illinoensis	Illinois pondweed	23.81	76.19	23.81	0.00	0.00	4.76
Myriophyllum spicatum	Eurasian watermilfoil	23.81	76.19	23.81	0.00	0.00	4.76
Najas marina	Spiny naiad	19.05	80.95	19.05	0.00	0.00	3.81
Stuckenia pectinatus	Sago pondweed	9.52	90.48	9.52	0.00	0.00	1.90
Potamogeton amplifolius	Large-leaf pondweed	9.52	90.48	9.52	0.00	0.00	1.90
Chara spp.	Chara	9.52	90.48	9.52	0.00	0.00	1.90
Potamogeton zosteriformes	Flat-stem pondweed	4.76	95.24	4.76	0.00	0.00	0.95
Ceratophyllum demersum	Coontail	4.76	95.24	4.76	0.00	0.00	0.95
Filamentous algae	Filamentous algae	23.81					

5-10' stratum			Density Scale				
Scientific Name	**Common Name**	**Frequency of Occurrence**	**0**	**1**	**3**	**5**	**Dominance**
Myriophyllum spicatum	Eurasian watermilfoil	31.58	68.42	26.32	5.26	0.00	8.42
Ceratophyllum demersum	Coontail	26.32	73.68	26.32	0.00	0.00	5.26
Najas marina	Spiny naiad	15.79	84.21	15.79	0.00	0.00	3.16
Potamogeton illinoensis	Illinois pondweed	10.53	89.47	10.53	0.00	0.00	2.11
Potamogeton gramineus	Grassy pondweed	10.53	89.47	10.53	0.00	0.00	2.11
Chara spp.	Chara	10.53	89.47	10.53	0.00	0.00	2.11
Stuckenia pectinatus	Sago pondweed	5.26	94.74	5.26	0.00	0.00	1.05
Filamentous algae	Filamentous algae	36.84					

10-15' stratum			Density Scale				
Scientific Name	**Common Name**	**Frequency of Occurrence**	**0**	**1**	**3**	**5**	**Dominance**
Chara spp.	Chara	18.18	81.82	18.18	0.00	0.00	3.64
Utricularia vulgaris	Common bladderwort	9.09	90.91	9.09	0.00	0.00	1.82
Stuckenia pectinatus	Sago pondweed	9.09	90.91	9.09	0.00	0.00	1.82
Potamogeton illinoensis	Illinois pondweed	9.09	90.91	9.09	0.00	0.00	1.82
Potamogeton gramineus	Grassy pondweed	9.09	90.91	9.09	0.00	0.00	1.82
Najas marina	Spiny naiad	9.09	90.91	9.09	0.00	0.00	1.82
Filamentous algae	Filamentous algae	9.09					

Hackenburg Lake summer Tier II survey metrics and data as collected August 13, 2007.

Entire Lake (0-15')			**Density Scale**				
Scientific Name	**Common Name**	**Frequency of Occurrence**	**0**	**1**	**3**	**5**	**Dominance**
Ceratophyllum demersum	Coontail	67.74	32.26	41.94	16.13	9.68	27.74
Potamogeton gramineus	Grassy pondweed	9.68	90.32	9.68	0.00	0.00	1.94
Utricularia vulgaris	Common bladderwort	6.45	93.55	6.45	0.00	0.00	1.29
Stuckenia pectinatus	Sago pondweed	6.45	93.55	6.45	0.00	0.00	1.29
Chara spp.	Chara	6.45	93.55	6.45	0.00	0.00	1.29
Potamogeton illinoensis	Illinois pondweed	3.23	96.77	3.23	0.00	0.00	0.65
Potamogeton berchtoldii	Broad-leaf small pondweed	3.23	96.77	3.23	0.00	0.00	0.65
Myriophyllum spicatum	Eurasian watermilfoil	3.23	96.77	3.23	0.00	0.00	0.65
Filamentous algae	Filamentous algae	100.00					

0-5' stratum			**Density Scale**				
Scientific Name	**Common Name**	**Frequency of Occurrence**	**0**	**1**	**3**	**5**	**Dominance**
Ceratophyllum demersum	Coontail	63.64	36.36	36.36	18.18	9.09	27.27
Utricularia vulgaris	Common bladderwort	9.09	90.91	9.09	0.00	0.00	1.82
Potamogeton illinoensis	Illinois pondweed	9.09	90.91	9.09	0.00	0.00	1.82
Potamogeton gramineus	Grassy pondweed	9.09	90.91	9.09	0.00	0.00	1.82
Chara spp.	Chara	9.09	90.91	9.09	0.00	0.00	1.82
Filamentous algae	Filamentous algae	100.00					

5-10' stratum			**Density Scale**				
Scientific Name	**Common Name**	**Frequency of Occurrence**	**0**	**1**	**3**	**5**	**Dominance**
Ceratophyllum demersum	Coontail	76.92	23.08	38.46	23.08	15.38	36.92
Stuckenia pectinatus	Sago pondweed	15.38	84.62	15.38	0.00	0.00	3.08
Potamogeton gramineus	Grassy pondweed	15.38	84.62	15.38	0.00	0.00	3.08
Utricularia vulgaris	Common bladderwort	7.69	92.31	7.69	0.00	0.00	1.54
Potamogeton berchtoldii	Broad-leaf small pondweed	7.69	92.31	7.69	0.00	0.00	1.54
Myriophyllum spicatum	Eurasian watermilfoil	7.69	92.31	7.69	0.00	0.00	1.54
Chara spp.	Chara	7.69	92.31	7.69	0.00	0.00	1.54
Filamentous algae	Filamentous algae	100.00					

10-15' stratum			**Density Scale**				
Scientific Name	**Common Name**	**Frequency of Occurrence**	**0**	**1**	**3**	**5**	**Dominance**
Ceratophyllum demersum	Coontail	57.14	42.86	57.14	0.00	0.00	11.43
Filamentous algae	Filamentous algae	100.00					

Messick Lake summer Tier II survey metrics and data as collected August 13, 2007.

Entire Lake (0-15')			Density Scale				
Scientific Name	**Common Name**	**Frequency of Occurrence**	**0**	**1**	**3**	**5**	**Dominance**
Ceratophyllum demersum	Coontail	27.50	72.50	27.50	0.00	0.00	5.50
Stuckenia pectinatus	Sago pondweed	20.00	80.00	20.00	0.00	0.00	4.00
Potamogeton illinoensis	Illinois pondweed	12.50	87.50	10.00	2.50	0.00	3.50
Potamogeton gramineus	Grassy pondweed	12.50	87.50	12.50	0.00	0.00	2.50
Potamogeton amplifolius	Large-leaf pondweed	10.00	90.00	10.00	0.00	0.00	2.00
Myriophyllum spicatum	Eurasian watermilfoil	7.50	92.50	7.50	0.00	0.00	1.50
Najas guadalupensis	Southern naiad	5.00	95.00	5.00	0.00	0.00	1.00
Potamogeton natans	Floating-leaf pondweed	2.50	97.50	2.50	0.00	0.00	0.50
Potamogeton foliosis	Leafy pondweed	2.50	97.50	2.50	0.00	0.00	0.50
Najas marina	Spiny naiad	2.50	97.50	2.50	0.00	0.00	0.50
Filamentous algae	Filamentous algae	60.00					

0-5' stratum			Density Scale				
Scientific Name	**Common Name**	**Frequency of Occurence**	**0**	**1**	**3**	**5**	**Dominance**
Potamogeton illinoensis	Illinois pondweed	26.67	73.33	20.00	6.67	0.00	8.00
Stuckenia pectinatus	Sago pondweed	33.33	66.67	33.33	0.00	0.00	6.67
Ceratophyllum demersum	Coontail	33.33	66.67	33.33	0.00	0.00	6.67
Potamogeton gramineus	Grassy pondweed	26.67	73.33	26.67	0.00	0.00	5.33
Potamogeton amplifolius	Large-leaf pondweed	13.33	80.00	13.33	0.00	0.00	2.67
Myriophyllum spicatum	Eurasian watermilfoil	13.33	86.67	13.33	0.00	0.00	2.67
Potamogeton natans	Floating-leaf pondweed	6.67	93.33	6.67	0.00	0.00	1.33
Potamogeton foliosis	Leafy pondweed	6.67	93.33	6.67	0.00	0.00	1.33
Najas marina	Spiny naiad	6.67	93.33	6.67	0.00	0.00	1.33
Najas guadalupensis	Southern naiad	6.67	93.33	6.67	0.00	0.00	1.33
Filamentous algae	Filamentous algae	66.67					

5-10' stratum			Density Scale				
Scientific Name	**Common Name**	**Frequency of Occurence**	**0**	**1**	**3**	**5**	**Dominance**
Ceratophyllum demersum	Coontail	42.86	57.14	42.86	0.00	0.00	8.57
Stuckenia pectinatus	Sago pondweed	21.43	78.57	21.43	0.00	0.00	4.29
Potamogeton amplifolius	Large-leaf pondweed	14.29	85.71	14.29	0.00	0.00	2.86
Potamogeton illinoensis	Illinois pondweed	7.14	92.86	7.14	0.00	0.00	1.43
Potamogeton gramineus	Grassy pondweed	7.14	92.86	7.14	0.00	0.00	1.43
Najas guadalupensis	Southern naiad	7.14	92.86	7.14	0.00	0.00	1.43
Myriophyllum spicatum	Eurasian watermilfoil	7.14	92.86	7.14	0.00	0.00	1.43
Filamentous algae	Filamentous algae	64.29					

10-15' stratum			Density Scale				
Scientific Name	**Common Name**	**Frequency of Occurence**	**0**	**1**	**3**	**5**	**Dominance**
Filamentous algae	Filamentous algae	62.50					

APPENDIX C:

HYDRILLA INFORMATION

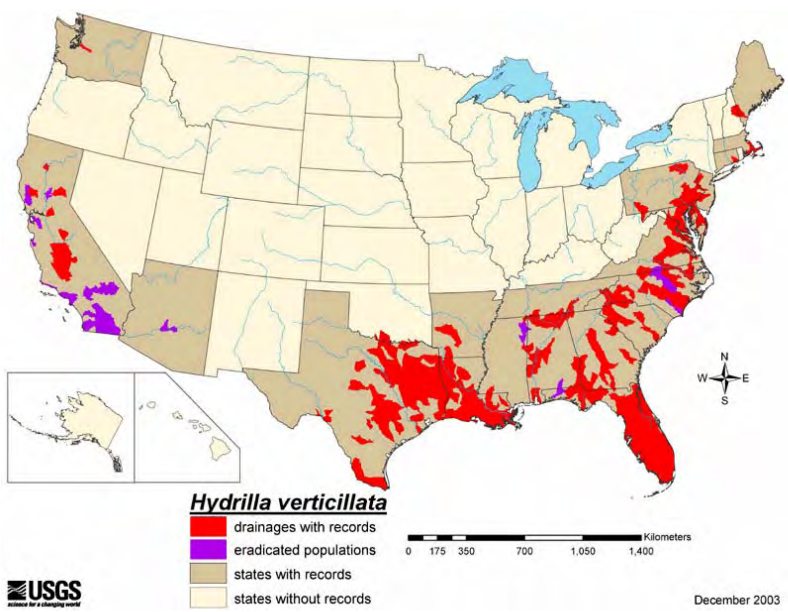
FIVE LAKES
AQUATIC PLANT MANAGEMENT PLAN UPDATE 2007

Aquatic Invasive Species

HYDRILLA

COMMON NAME: Hydrilla
Hydrilla is also known as water thyme, Florida elodea, Wasserquirl and Indian star-vine.

SCIENTIFIC NAME: *Hydrilla verticillata* (L.f.) Royle
Hydrilla's scientific name is made up of the Greek word "hydro" meaning "water" and the Latin word "verticillus" that means "the whorl of a spindle". Appropriately named, it is an aquatic plant with leaves that are whorled around the stem. Hydrilla is in the Frog's Bit family, or Hydrocharitaceae. It is the only species of the genus *Hydrilla* in the world though it resembles many of the other species in the family.



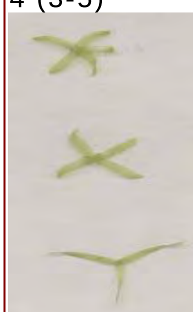
DISTRIBUTION: It is not really known where exactly hydrilla originated. Some sources give a broad native range of parts of Asia, Africa and Australia. Other sources are more specific and say that the dioecious form of hydrilla originated from the Indian subcontinent and the monoecious form originated from Korea. Currently the only continent without records of hydrilla is Antarctica.

Indiana: Hydrilla has not been detected in Indiana waters but it is on our Aquatic Nuisance Species watch list.

DESCRIPTION:

Leaves: Leaves are small about 2-4 mm wide and 6-20 mm long. They are strap-like with pointed tips and have visible saw-tooth margins. The leaves are whorled around the nodes in groups of 4-8 leaves. The leaf midvein is reddish in color and usually has a row of spines on it. This gives the plant a rough texture. The leaves are usually a green color, though topped out leaves could be bleached by the sun and appear more yellowish. Hydrilla has an axillary leaf scale called a squamula intravaginalis that is found next to the stem at the base of the leaf. This distinguishes it from the other species in the Hydrocharitaceae family. One may confuse hydrilla with another exotic weed, Brazilian elodea (*Egeria densa*). Hydrilla will have rough teeth on the underside of the leaves where Brazilian elodea will not. There is also a native species found in Indiana, American elodea (*Elodea canadensis*), which looks somewhat like hydrilla.

Identification Characteristics of the Hydrocharataceae

Character	Brazilian Elodea (*Egeria densa*)	American Elodea (*Elodea canadensis*)	Hydrilla (monoecious) (*Hydrilla verticillata*	Hydrilla (dioecious) (*Hydrilla verticillata*)
Leaves per Whorl	4 (3-5) 	3(2) 	5(2-8) 	4-5 (2-8) 
Serrated Edges Visible	With magnification	With magnification	Distinct on older plants	Distinct
Leaf Size	Up to 4cm	Up to 1.5 cm	1-2 cm	1-2 cm
Flowers	Male only, up to 2 cm	Tiny, male and female on separate plants	Male and female on same plants, to 1 cm	Only female plants in US, to 1 cm
Tubers Present	No	No	Yes	Yes

Roots/Stem: New root sprouts are white and when growing in highly organic soil they may be become brown. They are submerged and buried in the hydro-soil. Hydrilla stems are very slender only about 1/32 of an inch wide, but they can grow to lengths of 30 feet. When the stem nears the waters surface it branches out considerably. The monoecious form of hydrilla will usually start to branch out at the sediment level rather than at the top of the water.

Flowers: The flowers are imperfect (meaning there are separate male and female flowers) but the plant can be monoecious (flowers of both sexes on one plant) or dioecious (flowers of one sex being produced per plant). The female flower is white with three petals that alternate with three whitish sepals. The male flower has petals and sepals similar to the female flower, but the color could be white, reddish, or brown.

Fruits/Seeds: Hydrilla produce two different hibernacula to cover its buds. One is called a tuber, which forms terminally on rhizomes. They can be 5-10 mm long and are off white to yellow colored. Hydrilla also produces a turions which are compact dormant buds in the leaf axil. They are 5-8 mm long, dark green in color, and they appear to be spiny. The turion will break off and settle to the bottom of the water to start a new plant. The tubers are able to over winter and re-sprout as new plants as well. Seeds are also produced.

LIFE CYCLE BIOLOGY: Hydrilla is a submersed, herbaceous, perennial aquatic plant. It is capable of living in many different freshwater habitats. It will grow in springs, lakes, marshes, ditches, rivers, or anywhere there is a few inches of water. Hydrilla can tolerate low nutrient and high nutrient conditions as well as a salinity of up to 7%. Another adaptation hydrilla possesses, that enable it to out compete native plants, is the ability to grow in low light conditions. It is able to grow at deeper depths and can begin to photosynthesize earlier in the morning than most other aquatic plants. In the beginning stages of life hydrilla elongates at a rate of one inch per day. This continues until the plant comes close to the top of the water, here it begins to branch out. It produces a large mat of vegetation at the waters surface intercepting the light before it can reach other plants.

Hydrilla can reproduce in four different ways, fragmentation, tubers, turions, and seed. Fragmented pieces of hydrilla that contain at least one node are capable of sprouting into a new plant. The tubers of hydrilla are formed on the rhizomes and each one can produce 6,000 new tubers. When out of water a tuber can remain viable for several days, it can even lie dormant for over 4 years in undisturbed soil before sprouting a new plant. Turions are formed in the leaf axils of the plant. They are broken off and once settled in the sediment they can sprout into a new plant. Uncharacteristic of most plants, seed production in hydrilla is of least importance for reproduction. It seems that seed production is mostly used for long distance dispersal by means of ingestion by birds. The monoecious form of hydrilla puts more energy into tuber and turion production than does the dioecious form. It is good to know which form you have to decide on the best management technique.

The main adaptations that give hydrilla an advantage over other native plants are: it can grow at low light intensities, it is better at absorbing carbon dioxide from the water, it is able to store nutrients for later use, it can tolerate a wide range of water quality conditions, and it can propagate in four different ways.

PATHWAYS/HISTORY: Under the name Indian star-vine, hydrilla was imported into Florida as an aquarium plant in the 1950's. A farmer living near Tampa acquired the plant but was not impressed with it and threw it out into a canal behind his business. A few months later the farmer noticed that the hydrilla grew very well and decided to market it. By the 1960's severe problems caused by hydrilla were being reported. In 1990 hydrilla could be found in 187 lakes and rivers in Florida. Because there are two different strains of hydrilla found in the United States, the monoecious strain and the dioecious strain, it is believed that there was a separate introduction outside of Florida. The dioecious form is mainly found in the southern states and California and the monoecious form is found north of South Carolina. Hydrilla was brought to national attention in 1980 when it was discovered in the Potomac River in Washington D.C. Currently hydrilla is found in approximately 690 bodies of water within 190 drainage basins of 21 states.

DISPERSAL/SPREAD: Once established hydrilla can easily spread to new areas. Fragmented pieces of the plant are able to root and develop into a new plant. These plant fragments are transported to new waters via boats and fishing equipment. Hydrilla's tubers and turions allow it to persist in an area. They can live dormant in the ground and can even resist a drought. Waterfowl are a vector of transport for hydrilla as well. Some waterfowl feed on the plant and may regurgitate the tubers into other bodies of water. It has been found that these tubers are still able to sprout. Birds can also spread seeds. Hydrilla is still sold for aquarium use over the Internet, which could mean expansion of its range through more introductions, accidental or otherwise.

RISKS/IMPACTS: Hydrilla is sometimes called an invisible menace because most of the time you don't know it is there until it has filled the water. It will shade out native aquatic plants until they are eliminated. This forms a monoculture, which will reduce biodiversity and alter the ecosystem. Hydrilla does not only pose a threat to other plants but to animals as well. When hydrilla becomes over abundant, fish population imbalances are likely. The dense mats of hydrilla will alter the waters chemistry by raising pH, cause wide oxygen fluctuations, and increase water temperature.

Hydrilla is an economic drain. Millions of dollars are lost due to reduced recreational opportunities as hydrilla mats interfere with boating, swimming, fishing, etc. In flowing waters hydrilla will greatly reduce flow and can cause flooding. For operations that require water intake, hydrilla can pose a problem by clogging the intake pipes. Waterfront property values drop in areas infested with hydrilla. Millions of dollars are annually spent trying to control this aquatic pest.

MANAGEMENT/PREVENTION: Control of aquatic weeds is difficult and eradication sometimes can be an unrealistic goal. Before any type of management technique can be implemented there needs to be a positive identification of the plant. Some native plants look similar to hydrilla so it is important to have proper identification.

Hydrilla has not yet appeared in Indiana, however it is not far away. If this plant shows up in Indiana waters, it needs to be eliminated immediately. While there are many methods available to control aquatic plants, the method most suitable for complete and fast elimination is chemical control. Aquatic herbicides containing the active ingredient endothall, fluridone, or diquat are all labeled for use on hydrilla.

For states that have major infestations of this pest plant, they have looked to hydrilla's native range for any insects that could be used as a biological control. Four hydrilla-attacking insects have been released. *Bagous affinis*, a hydrilla tuber-attacking weevil and *Hydrellia pakistanae*, a leaf-mining fly both were released in 1987. *Hydrellia balciunasi* is another leaf mining fly that was released in 1989. *Bagous hydrillae*, a stem-mining weevil, was released in 1991. Many different states have released one or a combination of the four insects. It is still too early to know what long-term impacts these insects will have on hydrilla. One Indiana company is helping to develop a biological control method for hydrilla. SePro Inc. of Carmel, Indiana is a cooperator in a project with U.S. Army Engineer Research and Development Center Environmental Laboratory to grow an endemic fungal pathogen that attacks hydrilla.

Hydrilla has been listed by the U.S. government as a Federal Noxious Weed. With this designation, it is illegal to import or sell the plant in the United States. However, it is likely that internet sales still occur.

Like all invasive species, the key to preventing their spread is knowledge! You can also help by practicing a few good techniques to stop the spread of hydrilla and other aquatic invasive plants.

- ✓ Rinse any mud and/or debris from equipment and wading gear and drain any water from boats before leaving a launch area.

- ✓ Remove all plant fragments from the boat, propeller, and boat trailer. The transportation of plant material on boats, trailers, and in livewells is the main introduction route to new lakes and rivers.

- ✓ Do not release aquarium or water garden plants into the wild, rather seal them in a plastic bag and dispose in the trash.

- ✓ Consider using plants native to Indiana in aquariums and water gardens.

- ✓ If you detect this plant in a lake, pond, or stream, immediately contact the Indiana Department of Natural Resources, Division of Fish and Wildlife.
    - (317)232-4080
    - dkeller@dnr.IN.gov
    - 402 W. Washington St., Rm W273
      Indianapolis, IN 46204

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PHOTOGRAPHS compliments of the Washington Department of Ecology

Updated 3/05

APPENDIX D:

2008 AQUATIC PLANT TREATMENT PERMIT APPLICATIONS

FIVE LAKES
AQUATIC PLANT MANAGEMENT PLAN UPDATE 2007

APPLICATION FOR AQUATIC VEGETATION CONTROL PERMIT

State Form 26727 (R / 11-03)
Approved State Board of Accounts 1987

☐ Whole Lake ☒ Multiple Treatment Areas
Check type of permit

INSTRUCTIONS: Please print or type information

FOR OFFICE USE ONLY
License No.
Date Issued
Lake County

Return to:
DEPARTMENT OF NATURAL RESOURCES
Division of Fish and Wildlife
Commercial License Clerk
402 West Washington Street, Room W273
Indianapolis, IN 46204

FEE: $5.00

Applicant's Name: Five Lakes Conservation Association	Lake Assoc. Name: Five Lakes Conservation Association	
Rural Route or Street: P.O. Box 304		Phone Number: 260-637-1856
City and State: Wolcottville, IN		ZIP Code: 46795
Certified Applicator (if applicable)	Company or Inc. Name	Certification Number
Rural Route or Street		Phone Number
City and State		ZIP Code

Lake (One application per lake): Witmer	Nearest Town: Wolcottville	County: Lagrange
Does water flow into a water supply		☐ Yes ☒ No

Please complete one section for *EACH* treatment area. Attach lake map showing treatment area and denote location of any water supply intake.

Treatment Area # 1 LAT/LONG or UTM's Treatment areas to be determined following May survey (see AVMP)

Total acres to be controlled <1 acre | Proposed shoreline treatment length (ft) | Perpendicular distance from shoreline (ft)

Maximum Depth of Treatment (ft) | Expected date(s) of treatment(s) mid to late May

Treatment method: ☒ Chemical ☐ Physical ☐ Biological Control ☐ Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. Spot treatment for Selective control of Eurasian watermilfoil using Renovate or 2,4-D

Plant survey method: ☒ Rake ☐ Visual ☐ Other (specify) Data collected during 2007 Summer survey (JFNew)

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community
Coontail		30%
Eurasian watermilfoil	X	45%
Sago pondweed		10%
Illinois pondweed		10%
Chara		5%

Treatment Area # 2	LAT/LONG or UTM's Treatment areas to be determined following May survey (see AVMP)		
Total acres to be controlled <1 acre	Proposed shoreline treatment length (ft)	Perpendicular distance from shoreline (ft)	
Maximum Depth of Treatment (ft)	Expected date(s) of treatment(s) mid to late May		
Treatment method: [X] Chemical	[ ] Physical	[ ] Biological Control	[ ] Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. Spot treatment for Selective control of Eurasian watermilfoil using Renovate or 2,4-D

Plant survey method: [X] Rake [ ] Visual [ ] Other (specify) Data collected during 2007 Summer survey (JFNew)

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community
Coontail		50%
Eurasian watermilfoil	x	30%
Sago pondweed		10%
Illinois pondweed		10%

INSTRUCTIONS: Whoever treats the lake fills in "Applicant's Signature" unless they are a professional. If they are a professional company who specializes in lake treatment, they should sign on the "Certified Applicant" line.

Applicant Signature	Date
Certified Applicant's Signature	Date

FOR OFFICE ONLY	
[ ] Approved [ ] Disapproved	Fisheries Staff Specialist
[ ] Approved [ ] Disapproved	Environmental Staff Specialist

Mail check or money order in the amount of $5.00 to:

DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FISH AND WILDLIFE
COMMERCIAL LICENSE CLERK
402 WEST WASHINGTON STREET ROOM W273
INDIANAPOLIS, IN 46204

Treatment Area # 3	LAT/LONG or UTM's Treatment areas to be determined following May survey (see AVMP)		
Total acres to be controlled <1 acre	Proposed shoreline treatment length (ft)	Perpendicular distance from shoreline (ft)	
Maximum Depth of Treatment (ft)	Expected date(s) of treatment(s) mid to late May		

Treatment method: [X] Chemical [ ] Physical [ ] Biological Control [ ] Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. Spot treatment for Selective control of Eurasian watermilfoil using Renovate or 2,4-D

Plant survey method: [X] Rake [ ] Visual [ ] Other (specify) Data collected during 2007 Summer survey (JFNew)

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community
Coontail		40%
Sago pondweed		10%
Eurasian watermilfoil	x	50%

INSTRUCTIONS: Whoever treats the lake fills in "Applicant's Signature" unless they are a professional. If they are a professional company who specializes in lake treatment, they should sign on the "Certified Applicant" line.

Applicant Signature	Date
Certified Applicant's Signature	Date

FOR OFFICE ONLY	
[ ] Approved [ ] Disapproved	Fisheries Staff Specialist
[ ] Approved [ ] Disapproved	Environmental Staff Specialist

Mail check or money order in the amount of $5.00 to:

DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FISH AND WILDLIFE
COMMERCIAL LICENSE CLERK
402 WEST WASHINGTON STREET ROOM W273
INDIANAPOLIS, IN 46204

Treatment Area # 4	LAT/LONG or UTM's Treatment areas to be determined following May survey (see AVMP)		
Total acres to be controlled <1 acre	Proposed shoreline treatment length (ft)	Perpendicular distance from shoreline (ft)	
Maximum Depth of Treatment (ft)	Expected date(s) of treatment(s) mid to late May		

Treatment method: [X] Chemical [ ] Physical [ ] Biological Control [ ] Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. Spot treatment for Selective control of Eurasian watermilfoil using Renovate or 2,4-D

Plant survey method: [X] Rake [ ] Visual [ ] Other (specify) Data collected during 2007 Summer survey (JFNew)

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community
Eurasian watermilfoil	x	60%
Coontail		20%
Illinios pondweed		10%
Northern watermilfoil		10%

INSTRUCTIONS: Whoever treats the lake fills in "Applicant's Signature" unless they are a professional. If they are a professional company who specializes in lake treatment, they should sign on the "Certified Applicant" line.

Applicant Signature	Date
Certified Applicant's Signature	Date

FOR OFFICE ONLY	
[ ] Approved [ ] Disapproved	Fisheries Staff Specialist
[ ] Approved [ ] Disapproved	Environmental Staff Specialist

Mail check or money order in the amount of $5.00 to:

DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FISH AND WILDLIFE
COMMERCIAL LICENSE CLERK
402 WEST WASHINGTON STREET ROOM W273
INDIANAPOLIS, IN 46204

Treatment Area # 5	LAT/LONG or UTM's Treatment areas to be determined following May survey (see AVMP)	
Total acres to be controlled <3 acre	Proposed shoreline treatment length (ft)	Perpendicular distance from shoreline (ft)
Maximum Depth of Treatment (ft)	Expected date(s) of treatment(s) mid to late May	

Treatment method: [X] Chemical [ ] Physical [ ] Biological Control [ ] Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. Spot treatment for Selective control of Eurasian watermilfoil using Renovate or 2,4-D

Plant survey method: [X] Rake [ ] Visual [ ] Other (specify) Data collected during 2007 Summer survey (JFNew)

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community
Eurasian watermilfoil	x	60%
Illinois pondweed		20%
Grassy pondweed		10%
Sago pondweed		10%

INSTRUCTIONS: Whoever treats the lake fills in "Applicant's Signature" unless they are a professional. If they are a professional company who specializes in lake treatment, they should sign on the "Certified Applicant" line.

Applicant Signature	Date
Certified Applicant's Signature	Date

FOR OFFICE ONLY

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[ ] Approved [ ] Disapproved	Environmental Staff Specialist

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DIVISION OF FISH AND WILDLIFE
COMMERCIAL LICENSE CLERK
402 WEST WASHINGTON STREET ROOM W273
INDIANAPOLIS, IN 46204

APPLICATION FOR AQUATIC VEGETATION CONTROL PERMIT
State Form 26727 (R / 11-03)
Approved State Board of Accounts 1987

☐ Whole Lake ☒ Multiple Treatment Areas
Check type of permit

INSTRUCTIONS: Please print or type information

FOR OFFICE USE ONLY
License No.
Date Issued
Lake County

Return to:
DEPARTMENT OF NATURAL RESOURCES
Division of Fish and Wildlife
Commercial License Clerk
402 West Washington Street, Room W273
Indianapolis, IN 46204

FEE: $5.00

Applicant's Name: Five Lakes Conservation Association	Lake Assoc. Name: Five Lakes Conservation Association	
Rural Route or Street: P.O. Box 304		Phone Number: 260-637-1856
City and State: Wolcottville, IN		ZIP Code: 46795
Certified Applicator (if applicable)	Company or Inc. Name	Certification Number
Rural Route or Street		Phone Number
City and State		ZIP Code

Lake (One application per lake): Westler	Nearest Town: Wolcottville	County: Lagrange
Does water flow into a water supply		☐ Yes ☒ No

Please complete one section for *EACH* treatment area. Attach lake map showing treatment area and denote location of any water supply intake.

Treatment Area # 1	LAT/LONG or UTM's: Treatment areas to be determined following May survey (see AVMP)	
Total acres to be controlled: <1 acre	Proposed shoreline treatment length (ft)	Perpendicular distance from shoreline (ft)
Maximum Depth of Treatment (ft)	Expected date(s) of treatment(s): mid to late May	

Treatment method: ☒ Chemical ☐ Physical ☐ Biological Control ☐ Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. Spot treatment for Selective control of Eurasian watermilfoil using Renovate or 2,4-D

Plant survey method: ☒ Rake ☐ Visual ☐ Other (specify) Data collected during 2007 Summer survey (JFNew)

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community
Coontail		35%
Eurasian watermilfoil	X	45%
Grassy pondweed		5%
Illinois pondweed		15%

Treatment Area # 2	LAT/LONG or UTM's Treatment areas to be determined following May survey (see AVMP)	
Total acres to be controlled <1 acre	Proposed shoreline treatment length (ft)	Perpendicular distance from shoreline (ft)
Maximum Depth of Treatment (ft)	Expected date(s) of treatment(s) mid to late May	

Treatment method: [X] Chemical [ ] Physical [ ] Biological Control [ ] Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. Spot treatment for Selective control of Eurasian watermilfoil using Renovate or 2,4-D

Plant survey method: [X] Rake [ ] Visual [ ] Other (specify) Data collected during 2007 Summer survey (JFNew)

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community
Coontail		30%
Eurasian watermilfoil	X	45%
Grassy pondweed		10%
Illinois pondweed		15%

INSTRUCTIONS: Whoever treats the lake fills in "Applicant's Signature" unless they are a professional. If they are a professional company who specializes in lake treatment, they should sign on the "Certified Applicant" line.

Applicant Signature	Date
Certified Applicant's Signature	Date

FOR OFFICE ONLY

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[ ] Approved [ ] Disapproved	Environmental Staff Specialist

Mail check or money order in the amount of $5.00 to:

DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FISH AND WILDLIFE
COMMERCIAL LICENSE CLERK
402 WEST WASHINGTON STREET ROOM W273
INDIANAPOLIS, IN 46204

APPLICATION FOR AQUATIC VEGETATION CONTROL PERMIT

State Form 26727 (R / 11-03)
Approved State Board of Accounts 1987

☐ Whole Lake   ☒ Multiple Treatment Areas
Check type of permit

INSTRUCTIONS: Please print or type information

FOR OFFICE USE ONLY
License No.
Date Issued
Lake County

Return to:
DEPARTMENT OF NATURAL RESOURCES
Division of Fish and Wildlife
Commercial License Clerk
402 West Washington Street, Room W273
Indianapolis, IN 46204

FEE: $5.00

Applicant's Name: Five Lakes Conservation Association	Lake Assoc. Name: Five Lakes Conservation Association	
Rural Route or Street: P.O. Box 304		Phone Number: 260-637-1856
City and State: Wolcottville, IN		ZIP Code: 46795
Certified Applicator (if applicable)	Company or Inc. Name	Certification Number
Rural Route or Street		Phone Number
City and State		ZIP Code

Lake (One application per lake): Dallas	Nearest Town: Wolcottville	County: Lagrange
Does water flow into a water supply		☐ Yes ☒ No

Please complete one section for *EACH* treatment area. Attach lake map showing treatment area and denote location of any water supply intake.

Treatment Area # 1	LAT/LONG or UTM's: Treatment areas to be determined following May survey (see AVMP)	
Total acres to be controlled: <3 acres	Proposed shoreline treatment length (ft)	Perpendicular distance from shoreline (ft)
Maximum Depth of Treatment (ft)	Expected date(s) of treatment(s): mid to late May	

Treatment method: ☒ Chemical ☐ Physical ☐ Biological Control ☐ Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. Spot treatment for Selective control of Eurasian watermilfoil using Renovate or 2,4-D

Plant survey method: ☒ Rake ☐ Visual ☐ Other (specify) Data collected during 2007 Summer survey (JFNew)

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community
Eurasian watermilfoil	X	35%
Variable-leaf pondweed		20%
Spiny naiad		15%
Illinois pondweed		10%
Southern naiad		10%
Northern watermilfoil		10%

Treatment Area # 2	LAT/LONG or UTM's Treatment areas to be determined following May survey (see AVMP)		
Total acres to be controlled <9 acres	Proposed shoreline treatment length (ft)	Perpendicular distance from shoreline (ft)	
Maximum Depth of Treatment (ft)	Expected date(s) of treatment(s) mid to late May		

Treatment method: [X] Chemical [ ] Physical [ ] Biological Control [ ] Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. Spot treatment for Selective control of Eurasian watermilfoil using Renovate or 2,4-D

Plant survey method: [X] Rake [ ] Visual [ ] Other (specify) Data collected during 200 Summer survey (JFNew)

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community
Eurasian watermilfoil	X	45%
Variable-leaf pondweed		25%
Spiny naiad		10%
Illinois pondweed		10%
Southern naiad		5%
Northern watermilfoil		5%

INSTRUCTIONS: Whoever treats the lake fills in "Applicant's Signature" unless they are a professional. If they are a professional company who specializes in lake treatment, they should sign on the "Certified Applicant" line.

Applicant Signature	Date
Certified Applicant's Signature	Date

FOR OFFICE ONLY	
[ ] Approved [ ] Disapproved	Fisheries Staff Specialist
[ ] Approved [ ] Disapproved	Environmental Staff Specialist

Mail check or money order in the amount of $5.00 to:

DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FISH AND WILDLIFE
COMMERCIAL LICENSE CLERK
402 WEST WASHINGTON STREET ROOM W273
INDIANAPOLIS, IN 46204

Return to: Page 1 of 2

DEPARTMENT OF NATURAL RESOURCES
Division of Fish and Wildlife
Commercial License Clerk
402 West Washington Street, Room W273
Indianapolis, IN 46204

FEE: $5.00

APPLICATION FOR AQUATIC VEGETATION CONTROL PERMIT

State Form 26727 (R / 11-03)
Approved State Board of Accounts 1987

☐ Whole Lake ☒ Multiple Treatment Areas
Check type of permit

INSTRUCTIONS: Please print or type information

FOR OFFICE USE ONLY
License No.
Date Issued
Lake County

Applicant's Name: Five Lakes Conservation Association	Lake Assoc. Name: Five Lakes Conservation Association	
Rural Route or Street: P.O. Box 304		Phone Number: 260-637-1856
City and State: Wolcottville, IN		ZIP Code: 46795
Certified Applicator (if applicable)	Company or Inc. Name	Certification Number
Rural Route or Street		Phone Number
City and State		ZIP Code

Lake (One application per lake): Hackenburg	Nearest Town: Wolcottville	County: Lagrange
Does water flow into a water supply		☐ Yes ☒ No

Please complete one section for *EACH* treatment area. Attach lake map showing treatment area and denote location of any water supply intake.

Treatment Area # 1 — LAT/LONG or UTM's: Treatment areas to be determined following May survey (see AVMP)

Total acres to be controlled: <1 acres — Proposed shoreline treatment length (ft): — Perpendicular distance from shoreline (ft):

Maximum Depth of Treatment (ft): — Expected date(s) of treatment(s): mid to late May

Treatment method: ☒ Chemical ☐ Physical ☐ Biological Control ☐ Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. Spot treatment for Selective control of Eurasian watermilfoil using Renovate or 2,4-D

Plant survey method: ☒ Rake ☐ Visual ☐ Other (specify) Data collected during 2007 Summer survey (JFNew)

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community
Coontail		35%
Eurasian watermilfoil	X	25%
Illinois pondweed		10%
Chara		10%
Variable-leaf pondweed		10%
Large-leaf pondweed		10%

Treatment Area #	LAT/LONG or UTM's	
Total acres to be controlled	Proposed shoreline treatment length (ft)	Perpendicular distance from shoreline (ft)
Maximum Depth of Treatment (ft)	Expected date(s) of treatment(s)	

Treatment method: ☐ Chemical ☐ Physical ☐ Biological Control ☐ Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. ______

Plant survey method: ☐ Rake ☐ Visual ☐ Other (specify) ______

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community

INSTRUCTIONS: Whoever treats the lake fills in "Applicant's Signature" unless they are a professional. If they are a professional company who specializes in lake treatment, they should sign on the "Certified Applicant" line.

Applicant Signature	Date
Certified Applicant's Signature	Date

FOR OFFICE ONLY	
☐ Approved ☐ Disapproved	Fisheries Staff Specialist
☐ Approved ☐ Disapproved	Environmental Staff Specialist

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COMMERCIAL LICENSE CLERK
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INDIANAPOLIS, IN 46204

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Division of Fish and Wildlife
Commercial License Clerk
402 West Washington Street, Room W273
Indianapolis, IN 46204

APPLICATION FOR AQUATIC VEGETATION CONTROL PERMIT

State Form 26727 (R / 11-03)
Approved State Board of Accounts 1987

☐ Whole Lake ☒ Multiple Treatment Areas
Check type of permit

FOR OFFICE USE ONLY
License No.
Date Issued
Lake County

FEE: $5.00

INSTRUCTIONS: Please print or type information

Applicant's Name: Five Lakes Conservation Association	Lake Assoc. Name: Five Lakes Conservation Association	
Rural Route or Street: P.O. Box 304		Phone Number: 260-637-1856
City and State: Wolcottville, IN		ZIP Code: 46795
Certified Applicator (if applicable)	Company or Inc. Name	Certification Number
Rural Route or Street		Phone Number
City and State		ZIP Code

Lake (One application per lake): Messick	Nearest Town: Wolcottville	County: Lagrange
Does water flow into a water supply		☐ Yes ☒ No

Please complete one section for *EACH* treatment area. Attach lake map showing treatment area and denote location of any water supply intake.

Treatment Area # 1 LAT/LONG or UTM's Treatment areas to be determined following May survey (see AVMP)

Total acres to be controlled <1 acre | Proposed shoreline treatment length (ft) | Perpendicular distance from shoreline (ft)

Maximum Depth of Treatment (ft) | Expected date(s) of treatment(s) mid to late May

Treatment method: ☒ Chemical ☐ Physical ☐ Biological Control ☐ Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. Spot treatment for Selective control of Eurasian watermilfoil using Renovate or 2,4-D

Plant survey method: ☒ Rake ☐ Visual ☐ Other (specify) Data collected during 2007 Summer survey (JFNew)

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community
Coontail		35%
Eurasian watermilfoil	X	30%
Spiny naiad		10%
Illinois pondweed		10%
Chara		10%
Southern naiad		5%
Northern watermilfoil		5

Treatment Area #	LAT/LONG or UTM's	
Total acres to be controlled	Proposed shoreline treatment length (ft)	Perpendicular distance from shoreline (ft)
Maximum Depth of Treatment (ft)	Expected date(s) of treatment(s)	

Treatment method: ☐ Chemical ☐ Physical ☐ Biological Control ☐ Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. ______

Plant survey method: ☐ Rake ☐ Visual ☐ Other (specify) ______

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community

INSTRUCTIONS: Whoever treats the lake fills in "Applicant's Signature" unless they are a professional. If they are a professional company who specializes in lake treatment, they should sign on the "Certified Applicant" line.

Applicant Signature	Date
Certified Applicant's Signature	Date

FOR OFFICE ONLY

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